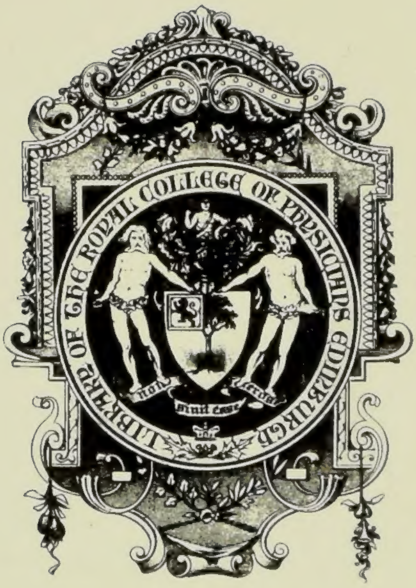
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A SYSTEM OF SURGERY,

BY

J. M. CHELIUS.

TRANSLATED FROM THE GERMAN

BY

JOHN F. SOUTH.

VOL. II.

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LONDON: PRINTED BY W. CLOWES AND SONS, STAMFORD STREET.

A

SYSTEM OF SURGERY,

BY

J. M. CHELIUS,

DOCTOR IN MEDICINE AND SURGERY, PUBLIC PROFESSOR OF GENERAL AND OPHTHALMIC
SURGERY, DIRECTOR OF THE CHIRURGICAL AND OPHTHALMIC CLINIC
IN THE UNIVERSITY OF HEIDELBERG,
&c. &c. &c.

TRANSLATED FROM THE GERMAN,

AND

ACCOMPANIED WITH ADDITIONAL NOTES AND OBSERVATIONS,

BY

JOHN F. SOUTH,

LATE PROFESSOR OF SURGERY TO THE ROYAL COLLEGE OF SURGEONS OF ENGLAND,
AND ONE OF THE SURGEONS TO ST. THOMAS'S HOSPITAL.

VOL. II.

LONDON:
HENRY RENSHAW, 356 STRAND;
MACLACHLAN, STEWART, & CO., EDINBURGH; AND
FANNIN & CO., DUBLIN.

1847.

SECOND DIVISION.

(CONTINUED.)

III.—SOLUTION OF CONTINUITY FROM ALTERED POSITION OF PARTS.

(CONTINUED.)

B.—OF RUPTURES.

1109. *A Rupture* (*Hernia*, Lat.; *Bruch*, Germ.; *Hernie*, Fr.) is the protrusion of an intestine from its own cavity into the surrounding cellular tissue, or into another cavity. Ruptures are therefore distinguished, according to the three cavities of our body, as *ruptures of the belly*, *of the chest*, and *of the head.*

I.—Of Ruptures of the Belly.

First Chapter.—OF RUPTURES OF THE BELLY IN GENERAL.

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1110. Ruptures of the Belly (*Herniæ abdominales*) may occur throughout the whole extent of its wall, if this give way or be torn. Most commonly they occur at those parts of the belly where there are already openings for the passage of vessels, nerves, and so on.

1111. According to the various parts at which ruptures are formed, they are distinguished as, 1, *Inguinal*, which pass through the inguinal canal; 2, *Femoral*, beneath POUPART's ligament; 3, *Umbilical*, through the umbilical hole; 4, *Thyroid*, through the thyroid hole; 5, *Ischiatic*, through the ischiatic notch; 6, *Ventral*, through the wall of the belly, the holes already mentioned excepted; 7, *Perinæal*; 8, *Vaginal*; 9, *Rectal*, when the rupture protrudes at the *perinæum*, in the *vagina*, or in the *rectum* (1).

Inguinal, femoral and umbilical are the most common ruptures, the others are more rare.

[(1) To this list must certainly be added *Phrenic* rupture (*Hernia diaphragmatica.*) And English Surgeons speak also of *mesenteric, meso-colic*, and *meso-rectal* ruptures, although strictly speaking they do not resemble true ruptures in leaving their proper cavity, but they burst through parts which have no natural opening for their passage and thus become displaced.—J. F. S.]

1112. Those intestines of the belly which on account of their position and connexion are least fixed, protrude most commonly, as the *omentum* and the small intestines, more rarely the large intestines, the stomach, the bladder, the internal female generative organs, and the like. Parts may be in the rupture which in their natural place are very far from it. These are either drawn down by the protruding intestines, with which they are connected, or by the descent of the *peritoneum*, to which they are attached. According to the intestine which ruptures contain are they distinguished as *intestinal*, (*Hernia Intestinalis*, Lat.; *Darmbruch*, Germ.; *Enterocèle*, Fr.,) *omental*, (*Hernia Omentalis*, Lat.; *Netzbruch*, Germ.; *Epiplocèle*, Fr.,) *ventricular*, (*Hernia Ventriculi*, Lat.; *Magenbruch*, Germ.; *Gastrocèle*, Fr.,) *vesical*, (*Hernia Vesicæ*, Lat.; *Harnblasenbruch*, Germ.; *Cystocèle*, Fr.,) and so on. Several intestines may be contained at the same time in one sac, as for instance intestine and *omentum*, (*Darmnetzbruch*, Germ.; *Entero-epiplocèle*, Fr.,) and the like.

1113. When the intestines of the belly are protruded into a rupture, they are usually enclosed in a sac, (*saccus herniosus*, Lat.; *Bruchsack*, Germ.; *sac herniaire*, Fr.,) which is formed of the lengthened *peritoneum*. In rare cases only is this sac deficient; for instance, when the rupture is caused by great violence, or after previous wound of the wall of the belly, or after the application of escharotics for the radical cure of the rupture. The sac may also be torn, or destroyed by absorption. If intestines protrude, which are not enclosed in the *peritoneum*, for example, the bladder (1) and *cæcum* (2), there is not any sac; but if they be much protruded, they draw down the *peritoneum* connected with them, and thereby form a sac into which other intestines may pass.

[(1) In regard to vesical rupture, it is certainly just possible that the bladder may rise to the internal abdominal ring, and thrusting up the *peritoneum* from that opening, may protrude some part of its body uncovered by *peritoneum* through it, and this may continue to descend through the inguinal canal and form a rupture without a peritoneal or true hernial sac. But such state of things is highly improbable, and in the two cases of vesical rupture in the museum at St. Thomas's is certainly not so, for in this preparation it is the *fundus* of the bladder, that part of the organ most likely to be protruded, with its peritoneal covering which has passed through the abdominal ring into a distinct peritoneal sac, which from its appearance probably belonged originally to a rupture of the intestinal or omental kind.

(2) I do not think that the *cæcum* would often protrude as a rupture without having a peritoneal sac, more than the bladder, and for nearly the same reasons. There is, however, in the Museum at St. Bartholomew's a *cæcum* carried into the *scrotum* with a partial sac, and I have also had one case in which I suspect the *colon* did. But

that it does descend into a true hernial sac is beyond doubt, for in the museum of the Royal College of Surgeons of England, there is an instance of the lower end of the *ileum*, the *cæcum* and its appendage, and part of the ascending *colon*, with a large piece of *omentum* in the sac of a large oblique inguinal rupture. There is also another preparation, in which the lower end of the *ileum*, with the *cæcum* and its appendage, are in the sac of an inguinal rupture, and the extremity of the appendage is attached to the bottom of the sac. In St. Bartholomew's museum there is a scrotal rupture (with hydrocele in front) containing *cæcum* and *colon*. Also a femoral rupture, in which there is small intestine, a portion of the sigmoid flexure of the *colon* and *omentum*.

A very rare instance of protrusion of the vermiform appendage of the *cæcum* in a strangulated inguinal rupture is given by TARAMELLI (*a*); the appendage alone was found in the sac, increased to four times its ordinary size, and an indent at its junction with the *cæcum* showed the seat of strangulation. The patient did well.—J. F. S.]

1114. The cavity of the hernial sac is connected with the cavity of the belly by an opening, the *mouth of the sac;* the narrow part between this opening and the greater extent of the sac is called the *neck of the sac;* the remaining part the *body;* and the blind end, the *bottom* of the hernial sac. The sac is furnished with different coverings according to the difference of place where the rupture exists; on its outer surface it is slightly connected with the surrounding cellular tissue, and therefore the sac remains external when the intestines have been returned.

1115. The hernial sac is very frequently subject to changes. The *peritoneum* of which it is formed usually retains its natural condition, and when in old ruptures it thickens, and is found to consist of several layers, the cause of these changes, for the most part, rests on the thickening of the cellular tissue, which covers the outer surface of the sac. The substance of the *peritoneum* itself, however, often thickens and even becomes almost cartilaginised (1). These changes are the result of the irritation and pressure to which the sac is subjected, by the passage forwards and backwards of the intestines; they therefore occur especially in old ruptures which cannot be properly kept up by the truss, and mostly at the neck of the sac. If by contraction of the neck of the sac, or by thickening of the cellular tissue covering it, a narrowing be produced, it may in the gradual increasing volume of the rupture descend, and thus may several strictures be formed in the body of the sac (2). These changes are not always relative to the size of the sac. In large ruptures the sac is often very thin, even so thin, that the peristaltic movement of the intestines can be perceived through the external skin. In large umbilical ruptures the hernial sac is often very thin, and in small femoral ruptures very thick. Swellings also may form on the sac from degeneration of the cellular tissue (3).

[(1) In the museum at St. Thomas's, there is a preparation of a femoral hernial sac converted into bone.

(2) I do not agree with CHELIUS's statement on the causes of stricture in the body of the hernial sac. As regards the descent of the neck, or more properly, the mouth of the sac, into its cavity, so that the stricture is not at the immediate opening into the cavity of the belly, but at a less or greater distance below it, so far as I have had opportunity of observing, it is of great rarity. I have only once seen it, and that during last spring, in a case of oblique scrotal rupture, in a young man, which had existed for several years, and in which during the operation an extremely tight stricture was found very high up. This I divided upon a director sufficiently to admit my forefinger freely into the cavity of the belly; but with all the pains I could take I was unable to return the gut. After many unavailing efforts I cut through the tendon of the external oblique muscle and the other coverings of the upper part of the sac, till I brought its strictured mouth completely into view, which immediately explained the difficulty. The mouth of the sac had descended into its cavity, doubling the neck upon itself, so that a circular blind pouch about half an inch deep, encircled the mouth, which had the same relation to the sac as the mouth of the womb has to the *vagina*, and its margin had become so

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(*a*) OMODEI, Annali Universali di Medicina, vol. lxxv. p. 430. 1835.

firmly and narrowly thickened, that it resembled a ring of whipcord. Into this blind circular pouch the intestine had been thrust at every attempt I had made for its reduction, and thus both escaped, and shut up the mouth of the sac. The finger could be passed into the cavity of the belly, as freely as before; but I thought it best to divide this cord-like edge and the indoubled neck, so as to render the reduction more easy, and such was the result. The patient did well.

As to the production of strictures in the body of the sac, I believe that generally these depend much more frequently on bands of adhesive matter having been thrown out under inflammation of the peritoneal sac itself, from some accidental cause or other, rather than from thickening of the cellular tissue external to it, which, however, may take place, as I have seen it do, occasionally producing, not indeed actual bands or strictures, but merely an hour-glass contraction of the sac.

(3) Sometimes a hernial sac is contracted in its middle and assumes an hour-glass shape; such a case I have operated on, but it did not produce any confusion. Occasionally, however, it may, as is shown in a preparation at St. Bartholomew's, in which the sac of a congenital rupture has an hour-glass contraction at the abdominal ring, and part of it is without, whilst the other part is within the belly, and into the latter portion the gut had been returned, and left.—J. F. S.]

1116. The size of ruptures is very different. Often the rupture contains the greatest part of the intestines of the belly; often is it so small that it can be discovered only with the greatest care. Of the intestine itself there is protruded either an entire loop or only a portion.

1117. Several ruptures often occur in the same subject. Rarely are several, each having its own sac, at the same spot; more frequently, by the protrusion of the urinary bladder, or some other intestine only partially covered with *peritoneum*, so that the latter is drawn with it, a hernial sac is formed into which the intestines pass. A double hernial sac is very rare, and indeed possible only in inguinal hernia, where a special sac containing intestines may drive into the vaginal tunic of the testicle, when its mouth has remained open.

Bransby Cooper (*a*) mentions a case of two inguinal ruptures on the same side; the contents of the hinder, larger sac, which remained external, were returnable into the cavity of the belly, but the front smaller sac with its contained intestine had been easily returned into the belly, by the *taxis*; he does not, however, explain, how it happened that this thrusting up of the sac and its contents had been effected which is one of the most curious points of the case.

[Lawrence says, there is a "kind of double rupture not ascertainable in general, except by examination after death, or in operating, viz.:—two sacs passing through the same opening; this may happen in external or internal inguinal or crural *herniæ*. There are instances of even three sacs, particularly in inguinal *herniæ*." (p. 13)

As regards the number of hernial sacs, Astley Cooper says:—"Two herniary sacs have been stated to pass behind the same crural arch; but although I would ot be understood to deny their existence, I have not seen an example of sacs having two separate orifices into the cavity of the *abdomen*; but I have known one hernial sac descending into the sheath for the crural vessels, and crossing the anterior part of these, and another portion of it quitting the sheath and extending in the usual direction upon the thigh." (p. 4.) He also gives an example of six hernial sacs:—"Two of the sacs upon each side were placed between the umbilical and epigastric arteries; and one on each side is situated between the remains of the umbilical arteries and the *pubes*. They passed between the tendinous fibres of the *transversalis*, which they had separated, and entered the adominal rings, after which they were covered, as usual, by the *fascia*, which is extended from the external oblique muscle over the spermatic cord." (Explanation of pl. x. pt. i.) And he observes, that after wearing a truss, "although the original sac may be completely shut at its mouth by adhesion or perfect contraction, it is possible that another sac may be formed contiguous to the first." And he gives an instance, in which "two hernial sacs were found side by side, one open and capable of containing the bowels when protruded, the other contracted so much as not to admit a goose's quill." p. 23.)

Morgan (*b*) had a remakable instance of a pouch formed at the mouth of the *tunica*

(*a*) Guy's Hospital Reports, vol. iv. p. 326.

(*b*) Astley Cooper, above cited, p. 83.

vaginalis, in consequence of partial adhesions of the membrane. The patient had scrotal rupture on the right side, accompanied with symptoms of strangulation. It was reduced with great ease, by gentle application of the *taxis*. The symptoms, however, continued, and on the following day "a small tumour was perceptible in the course of the inguinal canal." On the third day he was worse, and an operation having been decided on, "after dividing the integuments, superficial *fascia*, and cremaster, in the usual manner, what appeared to be hernial sac was brought into view; this was laid open, and on the operator introducing his finger, it readily passed through the external ring into the inguinal canal; here an unnatural projection could be felt, but no gut was found, nor could the finger be passed into the *abdomen*. The inguinal canal was then exposed by slitting up the tendon of the external oblique, and the sac before mentioned was more extensively opened, still no intestine could be found, and no communication appeared to exist between the sac and the abdominal cavity. A substance was felt in the canal which resembled a thickening of the cord." Nothing more was done, and he died on the second day after the operation. Upon examination, the part "supposed to be hernial sac, and opened as such, was the reflected portion of the *tunica vaginalis*, into the cavity of which the finger had been introduced." The tumour in the course of the inguinal canal was a hernial sac, behind the cord, and containing a portion of strangulated intestine of a very dark colour, and with a large gangrenous spot. This *hernia*, had by its pressure, prevented the entrance of the finger into the belly. "Just below the opening of the *tunica vaginalis* into the *abdomen*, was situated the mouth of a preternatural pouch, which extended downwards and inwards behind the *fascia transversalis* in the direction of the crural ring. It was into this pouch that a portion of the *ileum* had descended and had there become strangulated. It seems probable that at the time of the man's admission into the hospital, a large portion of intestine had descended into the cavity of the *tunica vaginalis*, the cavity of which bore all the appearances of an old hernial sac. This, however, was easily returned, while the portion of bowel contained in the other pouch, remained unreduced and suffering under strangulation, caused the symptoms which ended in the patient's death." (p. 83.)

In the museum at St. Bartholomew's there are two beautiful preparations. one exhibiting two inguinal hernial sacs, on the left side, close together and of considerable length, the mouth of the outer very small; the other femoral, in which there are two distinct sacs and orifices, the outer descends beneath the semi-lunar edge of the *fascia lata*, but the inner is so small that it scarcely protrudes.

Sometimes the sac of a rupture is divided vertically into two, probably by adhesive inflammation. I have operated on one such scrotal case. In St. Bartholomew's museum there is a common scrotal and also a congenital scrotal rupture of similar kind.

In rare cases, one or other side of the sac of a femoral rupture is burst, and a part of its contents are protruded in either direction, so as to form a seeming second sac. I have had three cases of this kind, which will be hereafter noticed, and the case mentioned by ASTLEY COOPER, in which "one hernial sac descended into the sheath for the crural vessels and crossed the anterior part of these, and another portion of it quitted the sheath and extended in the usual direction upon the thigh," (p. 4), I believe to be of similar kind. Neither of these, however, are to be confused with the case described and figured by BRANSBY COOPER.—J. F. S.]

1118. Ruptures are either *free*, or *reducible*, (*frei*, *beweglich*, Germ.; *mobile*, Fr.,) when they return of themselves, or can be returned by moderate pressure; or *irreducible*, (*unbeweglich*, Germ.; *immobile*, Fr.,) when their return is impossible, the cause of which lies in the *adhesion of the intestines together* or *to the hernial sac*, in the *strangulation* or *other change of the parts found in the rupture*.

1119. As regards their origin, ruptures may be divided into *original* (*Herniæ congenitæ*, Lat.; *angeborne Bruch*, Germ.; *Hernie congénitale*, Fr.) and *acquired* (*Herniæ acquisitæ*, Lat.; *erworbene Bruch*, Germ; *Hernie acquise*, Fr.); in the first case the intestines pass through the processes of the *peritoneum*, which remain open; in the second, after the processes have closed or at some other place.

1120. The *causes* of abdominal ruptures are *predisposing* and *occasional*. Predisposition to rupture, which may be either original or acquired, consists in a relaxation and weakness of the wall of the belly, and in greater enlargement of its natural openings. It may be produced by corpulency, by great extension of the wall of the belly during dropsy or pregnancy, by quick emaciation, by scars after wounds, especially when the injury of the abdominal wall has been connected with bruising; by diseased changes of the intestines of the belly, by loading them with coarse food, by immoderate use of relaxing drinks and the like.

The occasional causes are all kinds of violence which produce great contraction of the wall of the belly and depression of the diaphragm, whereby the intestines are forcibly thrust against the former; for instance, a violent thrust or blow upon the belly, tight lacing, violent exertion on lifting heavy weights, in breathing, coughing, vomiting, in childbirth, peculiar positions, and so on. The greater the predisposing causes to rupture, the less requisite are the occasional causes; in great disposition to rupture, they often occur without any assignable occasional cause.

In many countries ruptures are very common, and their causes seem to depend on climate, on the mode of living, and on the particular exertions to which the inhabitants are subjected.

Ruptures occur more frequently in men than in women, and more frequently on the right than on the left side (1).

[(1) Lawrence has given the following curious statistical account of ruptures:—

“The comparative number of the different kinds of ruptures, and the relative frequency of the complaint generally, as well as that of its various forms in the two sexes, and at different periods of life, are exhibited in the following statement, extracted from the register of the patients relieved by the City of London Truss Society within twenty-eight years:—

In 83,584 patients, 67,798 were males, and 15,786 were females.

Males.	Females.			
14006	511	left inguinal	39419 inguinal	45629 single
24316	586	right inguinal		
278	2255	left femoral	6210 femoral	
421	3256	right femoral		
24966	286	double inguinal		27029 double
169	1608	double femoral		
664	2775	umbilical		4063
209	415	ventral		
1	3	peritoneal		4
1	4	obturator		5
26	46	have undergone operations		72
2289	1401	with umbilical and inguinal hernia have been cured		3690
446	243	with prolapsus ani		689
	2196	with prolapsus uteri		2392
	37	with prolapsus vaginæ		
	159	with prolapsus vesicæ		
6	5	with varix of the abdominal veins		11
67798	15786—83584			83584

In addition to the above statement, the following varieties in the situation of this malady have been noticed, viz. in

801 Males.

184	left inguinal and right femoral hernia,
82	left inguinal and left femoral hernia,
13	left inguinal and double femoral hernia,
10	left inguinal and ventral hernia,
13	left inguinal and umbilical hernia,
3	left inguinal hernia and prolapsus ani,
Carried forward 305	

Brought forward 305

3	left inguinal, umbilical, and ventral hernia,
135	right inguinal and left femoral hernia,
27	right inguinal and right femoral hernia,
25	right inguinal and double femoral hernia,
16	right inguinal and ventral hernia,
26	right inguinal and umbilical hernia,
7	right inguinal hernia and prolapsus ani,
1	right inguinal, umbilical, and ventral hernia,
87	double inguinal and right femoral hernia,
54	double inguinal and left femoral hernia,
27	double inguinal and double femoral hernia,
1	double inguinal and double femoral hernia outside of the femoral vessels,
12	double inguinal and ventral hernia,
1	double inguinal and double ventral hernia,
48	double inguinal and umbilical hernia,
18	double inguinal hernia and prolapsus ani,
2	double inguinal umbilical, and ventral hernia
1	left femoral and umbilical hernia,
1	right femoral and ventral hernia,
1	right femoral and umbilical hernia,
1	right femoral hernia outside of the femoral vessels,
801	

366 FEMALES.

13	left inguinal and left femoral hernia,
40	left inguinal and right femoral hernia,
1	left inguinal and double femoral hernia,
2	left inguinal and umbilical hernia,
6	left inguinal hernia and prolapsus uteri,
1	left inguinal hernia and prolapsus ani,
20	right inguinal and left femoral hernia,
5	right inguinal and right femoral hernia,
1	right inguinal and double femoral hernia,
9	right inguinal and umbilical hernia,
3	right inguinal and ventral hernia,
3	right inguinal hernia and prolapsus uteri,
1	double inguinal and right femoral hernia,
8	double inguinal and umbilical hernia,
5	double inguinal and ventral hernia,
1	double inguinal hernia and prolapsus uteri,
28	single femoral and umbilical hernia,
10	single femoral and ventral hernia,
1	left femoral and double ventral hernia on the right side,
1	left femoral and right obturator hernia,
3	left femoral hernia on the outside of the femoral vessels,
14	single femoral hernia and prolapsus uteri,
2	right femoral hernia on the outside of the femoral vessels,
1	right femoral hernia on inside and outside of the femoral vessels,
2	right femoral hernia, prolapsus uteri, and prolapsus vesicæ,
12	double femoral and umbilical hernia,
3	double femoral and large ventral hernia,
8	double femoral hernia and prolapsus uteri,
2	double femoral hernia and prolapsus ani,
22	umbilical and ventral hernia,
5	umbilical hernia and prolapsus uteri,
1	umbilical hernia, prolapsus uteri, and prolapsus vesicæ,
1	ventral hernia and prolapsus uteri,
5	prolapsus uteri and prolapsus ani,
109	prolapsus uteri and prolapsus vesicæ,
8	prolapsus uteri and prolapsus vaginæ,
10	prolapsus uteri, prolapsus vesicæ, and prolapsus vaginæ
366	

“ 5448 patients had congenital hernia

7299	patients were relieved with trusses under ten years of age.
4551	between 10 and 20
8715	20 — 30
13614	30 — 40
15627	40 — 50
14169	50 — 60
9761	60 — 70
3866	70 — 80
442	80 — 90
23	90 —100
78067	

“ Of 457 herniæ examined by M. Cloquet, 307 occurred in the male, 150 in the female sex; 246 on the right, 187 on the left side, and 24 on the middle line of the abdomen.

“ The numbers of the different kinds were as follows:—

Males.	Females.			
94	11	right external inguinal	203 external.	289 inguinal.
79	19	left		
39	8	right internal . . .	86 internal.	
35	4	left		
33	54	right femoral . . .	. . . .	134 crural.
22	25	left		
3	21	umbilical and linea alba	. . . .	24.
2	5	right obturator . . .	. . . .	10 obturator.
0	3	left		

Recherches sur les Causes et l'Anatomie des Hernies abdominales, p. 9, note.”]

1121. The following are generally the *symptoms of a reducible rupture of the belly*,—a swelling of quick or gradual production, not painful, elastic, of different form according to the opening by which it protrudes, on the surface of which the skin is unchanged, which can be returned by sufficient pressure, which returns of itself when the patient lies on his back, but after any exertion in coughing, sneezing, and the like, also after meal-time again protrudes or enlarges. It is accompanied with symptoms of disturbed intestinal functions, as sluggish bowels, rumblings in the bowels, belchings, disposition to vomit, dragging pains in the belly, and the like, which symptoms subside if the swelling be reduced, and afterwards the bowels are usually relieved.

If the rupture be small and deeply situated, the *diagnosis* is often difficult, and must be determined by close examination, by consideration of the origin of the swelling, and by all the existing symptoms.

1122. Decision as to the parts contained in the rupture is often very difficult, often even impossible, on account of the different changes which the parts themselves and the coverings of the rupture undergo.

[Chelius's observation, in reference to the difficulty or impossibility of distinguishing intestinal from omental rupture, is most fully borne out by practical experience, so that few persons are so hardy as to prognosticate the contents of a rupture-sac till it is opened.—J. F. S.]

1123. The *intestinal rupture* is characterized by a swelling more regular on its surface, elastic, which enlarges when the intestine is loaded, and in returning affords a gurgling noise (1), often felt in the swelling by the patient himself, and by the simultaneous symptoms of stoppage of the passage of the stools.

[(1) This gurgling noise is often entirely independent, I believe, of intestine, and caused by the quantity of fluid contained in the sac. And from the same cause arises a symptom which often puzzles a young Surgeon; to wit, the seeming reduction of a large portion of the contents of the sac, with a gurgling noise, whilst the remaining contents cannot be returned; and on the removal of the fingers, the rupture reacquires its original size, but admits of the same diminution, by pressure, only again to recover its bulk when the efforts at reduction are given up. This is very easily explained, as the fluid contained in the sac being pressed, squeezes between the sac and its contents into the cavity of the belly, although the intestine or *omentum* is so firmly grasped by the stricture that it cannot be returned.—J. F. S.]

1124. The *omental rupture* feels doughy, irregular, often rope-like, has a more cylindrical form with a broader base, is more slowly developed, is more difficult to reduce, is unaccompanied with any gurgling, and produces a heavy dragging upon the stomach.

1125. *Vesical rupture* is distinguished by the swelling fluctuating, enlarging, and becoming tense, if the patient retain his urine, and diminishing when he discharges it; and by pressure on the swelling exciting a disposition to void the urine. Frequently after making water, the tumour does not diminish, but the patient does not feel any disposition to urine, when it is pressed. As the bladder is always more or less dragged or pulled, the patient has a frequent disposition to make water; frequently the urine is completely retained, and in introducing a catheter, it must be observed that it be conducted in a peculiar manner into the bladder. If the vesical be complicated with omental or intestinal rupture, the symptoms are confused. Not unfrequently a stone is formed in the protruded part of the bladder.

1126. As to the other intestines which may be in the rupture, *the position of the rupture*, *its condition*, and the *disturbed functions of the contained parts*, afford the key. If several parts be together in the rupture, these symptoms are confused.

1127. Ruptures are always extremely important diseases. If they be left alone, and their neighbourhood be undisturbed, they always increase; the local and general inconveniences become greater, and the intestines may descend in such quantity into the rupture, that the greater part of them may rest in it. By the changes produced in the hernial sac (*par.* 1115) and the contained parts, the return of the rupture is rendered impossible, or strangulation is produced.

1128. The intestines contained in the rupture, may, in consequence of previous irritation, adhere to each other, or with the hernial sac, and the adhesion may be either a mere sticking together with a gelatinous mass, or it may be fibroid, or of a fleshy character, and may take place often only at certain parts, often to a great extent, so that all the parts of the rupture are consolidated into one mass. Omental ruptures grow together more readily than intestinal.

The adhesion of the hernial sac with the intestine, must be distinguished from those adhesions with the sac, which have existed before the production of the rupture, between the *peritoneum* and the intestines, in which the parts lying in the rupture, are, in the same way, attached to the sac, as it was earlier in the belly.

1129. The portion of intestine lying in the rupture, is generally thickened, and often considerably narrowed (1). This thickening of the tunics of the intestine may depend on the great development of their muscular coat, consequent on violent straining, for the purpose of driving forward its contents, in the obstructed return of the blood, or in the deposit of fibrine.

The *omentum* is very frequently very much changed in reference to its structure and form; it is usually thick and hard at the neck of the sac;

often rope-like, often rolled up into a hard lump; often is its bulk very much increased, beset with growths, and often exceedingly hardened.

[(1) I do not think that the protruded intestine is often either thickened or narrowed. The thickening which is sometimes observed in a strangulated gut, is of two kinds. The less important is when in consequence of strangulation, serum only is effused into the cellular tissue connecting the intestinal coats without other alteration, speedily subsides on the division of the stricture, and is not to be feared. The other kind, in which the cellular tissue of the gut is filled with adhesive matter, the result of a slow inflammatory action, and the intestinal wall acquires a thickness of the eighth of an inch or more, does not subside when the strangulation is removed, has a doughy feel, and is of a dirty reddish white colour, is a very dangerous symptom of the disease, and leads to the anticipation of an unfavourable termination of the case.—J. F. S.]

1130. When by a disproportion between the parts contained in the rupture, and the parts containing them, the communication between the belly and the rupture is arrested, *strangulation* (*Strangulatio*, Lat.; *Einklemmung*, Germ.; *Etranglement*, Fr.) ensues. The *causes* producing this disproportion are, increased protusion of the intestine in any exertion, overfilling of the intestine in the rupture with stools, intestinal gas, foreign bodies, and the like, consequent on overloading the stomach with food difficult of digestion and flatulent; growth of the protruded intestine, inflammatory swelling, degeneration of the *omentum*, and spasmodic affection of the intestinal canal.

1131. The seat of strangulation is either in the *opening into the belly*, through which the rupture has been produced (the *mouth of the rupture; Bruchpforte*, Germ.) or in the *hernial sac itself*.

1132. The *aponeurotic parts*, which form the abdominal mouth of the rupture, produce the strangulation of the parts protruded in great quantity, or increased in volume, never by *active* contraction, but because they do not yield any more, and by means of their elasticity, endeavour to return to their natural condition. Only in (external or oblique) inguinal ruptures, does a narrowing of the mouth of the rupture, by contraction of the wall of the belly, where the fibres of the internal oblique and transverse muscles surround the neck of the sac, seem possible to be produced.

1133. In the *hernial sac*, the confining part is either at the neck, or at various parts of its body, by narrowing and strictures which form in it, (*par.* 1115,) or it tears, and the intestines escaping through this opening become strangulated.

1134. The determination of the seat of the strangulation is often difficult, often impossible. The following circumstances may direct the practitioner:

Firstly. In a rupture which quickly arises from severe violence, or where, with little extensibility of the opening by which it has escaped, a large quantity of intestine is suddenly protruded, the unyieldingness of this opening is, for the most part, the cause of the strangulation. The hernial swelling does not spread upwards above the external abdominal ring, in inguinal rupture, the inguinal canal is throughout its whole extent yielding and free from pain; the pillars of the outer ring are stretched (*a*).

Secondly. That the strangulation is at the neck of the sac, as is most frequently the case, at least in inguinal ruptures, may probably be supposed, in ruptures which having been long kept up by a truss, suddenly protrude; when the aperture through which the rupture protrudes, not stretching, the hernial swelling, although very tense, is reducible, and in

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(*a*) Dupuytren, De l'Etranglement au collet du sac herniaire; in his Leçons orales de Clinique Chirurgicale, vol. i. p. 557.

the attempt to return it behind the abdominal ring, a swelling is formed. The inguinal canal is full, hard, tense, painful, and presents to the feel a cylindrical swelling.

Thirdly. Tearing of the hernial sac, or the inflammatory affection of the parts lying in the rupture, may be supposed to be causes of the strangulation, from the violence with which they operate upon the rupture itself; and in tearing the hernial sac, by the changes in its form which the hernial swelling undergoes from the projection of the intestines into the opening of the sac (*a*).

Fourthly. The overfilling of the intestines with intestinal matter, causes strangulation, mostly slowly, in old ruptures, by its gradual collection, or by overfilling the stomach. According to MALGAIGNE, never does solid matter, but only intestinal gas collect; the true ground of strangulation is inflammation, which is consequent on such ruptures.

Fifthly. The growth of the intestine itself, and the strangulation resulting therefrom, cannot be ascertained previous to operation.

MALGAIGNE'S supposition, that the strangulation is not produced by the ring, but at the neck of the sac, is too general; it is also opposed by DIDAY (*b*).

1135. According to the degree of disproportion between the containing and contained parts of the rupture, is the severity of the symptoms thereon depending. Therefore either merely the communication between the rupture and the cavity of the belly is stopped, (*Incarceration; Incarceratio Herniæ*, Lat.; *Einsperrung*, Germ.,) or the protruded parts are at the same time so compressed, that the circulation of the blood and other juices is prevented (*Strangulation; Strangulatio Herniæ*, Lat.; *Einklemmung*, Germ.) In the latter case, the symptoms are dependent on the arrested passage of the intestinal matter, and on inflammation; they become very active, on which account, this kind of strangulation is called *inflammatory* or *acute.* In the former case, at least at the onset, the symptoms depend only on the arrested passage of the stools, they are little severe, and may continue longer, wherefore this kind of strangulation is distinguished as *chronic;* but it runs earlier or later into inflammatory strangulation, if the disproportion proceed to the above-mentioned extent. It is usually connected with *long-continued overloading* of the intestine, lying in the rupture, with stools, or with spasmodic affection of the walls of the belly and intestines, in consequence of spasmodic, flatulent or bilious colic, by which the intestines are immovably retained in the rupture (*Spasmodic Incarceration.*)

Opinions are very various as to the nature of strangulation and the classification thereon grounded. Many assume that strangulation is always, as regards its nature, the same, that is, always *inflammatory*, and that no actual difference in its form occurs, but that it is only acute or chronic according to the degree and severity of the strangulation and the circumstances attending it (SCARPA, LAWRENCE, TRAVERS, BOYER VON WALTHER, JAËGER, and others.) Some take in its widest acceptation the division, proposed by RICHTER into inflammatory, spasmodic, and that caused by collection of stools, (LANGENBECK, WILHELM, BLASIUS, and others,) and differ only in their description of the symptoms, as they hold them, some as consequent on contraction of the abdominal muscles, especially of the front wall of the inguinal canal, (LANGENBECK,) some as a consequence of the contraction of the internal muscular inguinal ring, (A. COOPER,) and some as resulting from the spasmodic motion and contraction of the tendinous parts, arising from every trifling irritation (WILHELM.) RUST assumes, in reference to the seat of strangulation, a division *active* and *passive*, according as the parts forming the opening of the rupture contract, and grasp the protruded parts, or according

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(*a*) BREIDENBACH, Ueber Einklemmung durch Zerreisung des Bruchsaches; in Heidelberg klinischen Annalen, vol. ii. pt. 1.

(*b*) Gazette Médicale de Paris. 1841. No. 19.

to their morbid condition, and he assumes according to the causal relations of the strangulation, an inflammatory, spasmodic, organic (from the stricture of the hernial sac, loops of *omentum* or intestine, adhesions, and the like) and fæculent division. Sinogovitz (*a*) considers strangulation as varying only in degree, according as by it the communication is completely cut off or only rendered difficult to a greater or less extent; all the other statements applied to strangulation were only from sympathy of the alimentary canal, namely, from local hindrance of the circulation of the blood and contents of the intestine. This view was already taken by Seiler, and arranged according to this division under imperfect and perfect strangulation and incarceration, and also according to the symptoms, without inflammation, with collection of excrement, with spasm, and with inflammation (*b*).

From these various opinions may be observed, that the views above mentioned differ from each other chiefly in relation to spasmodic strangulation; that in the manner presumed by many, an active spontaneous contraction of the opening into the belly should take place, is just as untenable as the notion of an active strangulation in general; since a spontaneous contraction of the abdominal ring cannot be admitted, external or oblique inguinal rupture, perhaps, excepted, where the muscular fibres forming the internal ring may, as A. Cooper himself admits, contract. The spasmodic affection in ruptures must be sought not in the containing parts, but in the contents of the rupture; and as the inflammation, although not the cause, is usually a consequence of the strangulation, so must the spasm be considered as an important symptom accompanying the strangulation, by getting rid of which we may hope to be enabled to fulfil the principal indication, namely, to return the protruded intestine or to diminish the relatively too great bulk of the protruded parts. (Seiler.)

[The common and indiscriminate use of the terms strangulation and incarceration is very incorrect, for many ruptures are incarcerated which are not strangulated. An *incarcerated* rupture properly speaking is that kind of the disease, in which the protruded *omentum* or intestine, from some cause or other, cannot return or be returned into the belly, but does not produce any symptoms of disturbed intestinal functions. This is of very common occurrence, particularly in old and large ruptures, in which the only inconvenience is the bulkiness of the swelling. A *strangulated* rupture is on the contrary a most serious and quickly fatal disease. The protruded *omentum* sometimes tying down or compressing between itself and the hind wall of the belly, a portion or portions of the intestines still within the cavity of the belly, so as to prevent the passage of their contents, and thus causing vomiting and constipation; or a piece of intestine which has descended into the sac, is so girt by its neck, that the contents cannot pass through it, and even its mortification may ensue by the tightness of the neck of the sac preventing the flow of blood through it. These observations prove the marked distinction between incarceration and strangulation. It must, however, be remembered that every strangulated rupture is incarcerated till the stricture be removed, and it be rendered returnable; but the relief of the stricture does not necessarily get rid of the incarceration, as there may be other causes, as adhesions or size of the protruded part, which prevent its return. Therefore every strangulated rupture is incarcerated, and a rupture may be strangulated and incarcerated, or it may be simply incarcerated or incapable of return without producing any symptoms.—J. F. S.]

1136. The symptoms of *acute strangulation* which usually set in after the sudden protrusion of a considerable quantity of intestine, or in a suddenly produced rupture after violent exertion and the like, or in those which have been long kept up by a truss, are, more severe pain in the hernial swelling and a sensation, as if a cord were tied round the belly; the rupture is tense, elastic, and cannot be returned; belchings and vomiting of the contents of the stomach, subsequently, of bile, and at last, of fluid stool and part of the clysters; the vomiting becomes more or less frequent, either of itself, or after the use of every, even of the mildest drink; the pulse, at first, quick and hard, subsequently becomes small and contracted; the belly is tense and tender, as is also the hernial swelling, and the skin covering it is frequently reddened; from the first there is obstinate costiveness, but when there are excrements in the large intestines, they can be

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(*a*) Anleitung zu einer zweckmässigen Manual-hülfe bei eingeklemmten Leisten und Schenkel-brüchen. Danzig, 1830.

(*b*) Rust's Handb. der Chirurgie,—Art., *Hernia*.

emptied by clysters (1). In small ruptures which contain only one wall of the intestine, (LITTRE's (*a*) or *lateral rupture*,) the costiveness may be deficient or imperfect. If no assistance be afforded, the uneasiness, anxiety, tension, and painfulness of the belly and of the rupture increase, the vomiting becomes more frequent and painful, the body is covered with sweat, the pulse, quick, small, and thready, becomes irregular, the patient's countenance sinks in. Exacerbations and remissions of these symptoms, however, present themselves, and deceive both the patient and the practitioner.

[(1) Although costiveness is generally one of the symptoms of strangulation, it is by no means uncommon for the bowels to be relieved, and not unsparingly, although the strangulated bowel be impervious. This depends on the part of the intestinal canal strangulated; and the quantity of stool remaining in it below the protruded part.

I have on more than one occasion heard Surgeons of eminence speak of dilatation of a strangulated rupture on coughing, which I must confess I think impossible, if the rupture be more than incarcerated. LUKE, however, as will be hereafter shown (p.47,) when he describes the mode of ascertaining the seat of stricture, in reference to the operation for its division external to the sac, has explained that this dilatation is not of the part strangulated, but of that part of the rupture immediately above the seat of stricture, whilst that below remains unaltered. Such dilatation may happen when the seat of the stricture is at a distance below the mouth of the sac, but where the mouth itself is strictured, it cannot be possible.—J. F. S.

ASTLEY COOPER observes, that "when more than one irreducible *hernia* exists in the same person, it is sometimes difficult to determine which it is that requires operation;" and he mentions the case of a woman, in which there was a rupture in each groin and another at the navel. Her symptoms not being urgent, the operation was deferred, and she died on the same evening. On *examination*, "the tumour in the right groin was found to be an enlarged and inflamed absorbent gland, lying over an empty hernial sac. In the left groin was a portion of inflamed intestine, and at the navel was an irreducible omental *hernia*, which had suppurated, and contained about a table-spoonful of matter." (p. 36–7.)]

1137. In a slighter degree of inflammation, and when it is long confined merely to the seat of strangulation, the symptoms are less violent and come on more slowly. The pain in the belly is not severe, but rather forcing, the belly remains soft, and not painful, the vomiting recurs at longer periods, and with less violence, the pulse is little or not at all altered. The symptoms first become more severe on the farther extension and increase of the inflammation.

1138. The *incarceration* from overloading the intestines lying in the rupture, or from collection of stools, occurs mostly in old and large ruptures, where the mouth of the rupture is wide and has lost its elasticity, after the patient has for some days felt unusual weight and dragging in the rupture, after using food difficult of digestion and flatulent; the rupture is little or not at all painful, not very tense, weighty, and doughy to the feel, and requires greater pressure in attempting its reduction; the belly is indeed full and swelled up, but not painful; if pain come on, it intermits; then follow belchings, vomiting, and costiveness. This incarceration, if it cannot be got rid of by proper treatment, may continue a long time before the symptoms become urgent, but earlier or later inflammation accompanies them.

1139. If there be with this incarceration, spasmodic symptoms, or if they occur in consequence of chilling, (especially in the feet,) or if spasmodic colic exist in sensitive persons, hypochondriacal or hysterical women, and after ailments which produce spasmodic, flatulent, or bilious

(*a*) LITTRE; in Mémoires de l'Académie des Sciences. 1700. RIECHE, C. F., Ueber Darm-Anhangsbrüche (*Herniæ Littericæ*) mit Bermerkungen über Kothfisteln u. widernatürlichen After. Berlin, 1841; with one copper plate.

colic, the symptoms come on more quickly, the rupture although tense is little or not painful, often changes its form, becomes larger, and again smaller; the pain shifts its place, subsides and returns; the evacuation of the bowels ceases; the patient generally does not vomit often, only after some drinks, whilst others he retains; the pulse is small, contracted, and irregular; the urine generally pale; the respiration difficult; the symptoms often quickly attain a great height, but again subside. Inflammation supervenes earlier or later upon the symptoms above mentioned, and it is therefore necessary to be very careful not to be deceived by the symptoms of slight inflammation, and to consider it as consequent on spasmodic affection.

1140. If the strangulation be not relieved, sloughing of the confined part is to be feared, and so much the more as the strangulation and inflammation are severe. The parts enclosed in the rupture are often gangrenous, without the external parts presenting any such change. But usually on the occurrence of gangrene the swelling loses its elasticity and painfulness, the skin becomes bluish-black at several places, emphysematous, and the *epidermis* separates; the painfulness of the belly and the vomiting cease; the powers sink; the pulse becomes small and irregular; cold sweats cover the limbs and face of the patient; the features are altered; the ideas become confused; the swelling bursts and discharges very offensive stool. Most commonly gangrene is the forerunner of death, the patient, however, may under these circumstances recover, the sloughy part of the intestine separates, and its remaining extremities adhering to the *peritoneum*, form an *artificial anus*.

1141. If the *omentum* alone be strangulated, the symptoms are generally not so severe, because it can more easily bear compression in proportion, as its structure is not already changed. The inflammation, however, spreads from the constricted part to the other intestines. Although the relief of the bowels be not suppressed, yet belching and vomiting occur. The constricted *omentum* may pass into suppuration and gangrene (1). Suppuration is an uncommon result; an abscess may form above the constricted part which may empty itself into the belly. Sloughing often occurs without any great effect upon the general condition of the patient; the sloughy part separates, and the remaining part adheres to the opening.

[(1) Key (*a*) makes a very important remark in reference to strangulated omental rupture, which, however, I do not remember to have observed; he says:—" When from the nature of the symptoms the case appears to be merely an omental *hernia*, the operation must not be hastily proposed, for it is not easy to distinguish between inflammation of *omentum* which has been irreducible, and strangulation; for the inflamed state of the *omentum* without strangulation, the operation will afford no relief; on the contrary, it will aggravate the inflammation. It is highly advisable, therefore, to try the effects of active general depletion, and the application of leeches to the part, under which treatment the symptoms will often disappear. The result of operations on omental *hernia*, which have been attended by acute symptoms, as great tenderness of the part, continued sickness, tense and tender belly, has been such as to induce me to try every means of allaying the inflammatory action before resorting to the operation. The operation, in the cases that have come under my notice, has not suspended the symptoms, as it generally does in enterocele, but the patient has sunk within a few hours from the effects of the inflammation." (p. 36, *note.*)]

1142. The *treatment* of ruptures differs according to the different circumstances under which they are met with, namely, *reducible* or *irreducible*, *strangulated* or *gangrenous*.

1143. In *reducible ruptures* the indication is to reduce the protruded

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(*a*) A. Cooper, above cited.

parts and to prevent their reprotrusion. This treatment is either *palliative* by wearing a truss, or *radical*, by the organic closing of the hernial opening.

1144. The *reduction of a rupture* (*Taxis*, *Repositio Herniæ*, Lat.; *Zurückbringung eines Bruches*, Germ.; *Repoussement de la Hernie*, Fr.) is best effected early in the morning, when the bowels are empty, and the person is in a position, in which the walls of the belly are as much as possible relaxed, and the place of the rupture is most raised; therefore on the back, with the rump raised, the knees drawn up, and the body inclined towards the side on which the rupture is. Previous emptying of the urinary bladder, and of the large intestines with a clyster or purge will facilitate the *taxis*. The manœuvre of the reduction itself consists in a sufficiently moderate pressure upon the whole swelling, according to the direction in which it has been protruded; or in the greater size and more oblong form of the hernial swelling, the fingers of the right hand are to be applied from the bottom around the swelling, the thumb and the other fingers of the left hand upon the two sides of the abdominal opening, and then it is to be attempted with the right hand to return the rupture according to its direction, whilst with the fingers of the other hand the parts returned are to be kept up. Often the *taxis* operates very easily, but often a part of the contents of the intestine must be first returned by a moderate pressure on the rupture. During the reduction the patient must avoid all contraction of the walls of the belly. In proper positions of the body, small ruptures often return of themselves.

[In attempting the reduction of a rupture by the *taxis*, it is always advisable to make gentle and steady pressure over the whole swelling for a few minutes, in order to empty into the belly any fluid contained in the sac, so that the protruded gut or *omentum* may be more effectually acted on by the fingers. The same pressure should also be employed with the hope of emptying some part or all the contents of the intestine, if any be down, by which its bulk being reduced, its return is considerably facilitated by the special pressure of the *taxis*. The fluid of the sac can generally be emptied. so that a very considerable reduction in the size of the swelling is effected, and the Surgeon often fancies he has returned a large portion of the protruded gut or *omentum*, when in reality not the least part of it has moved, as the exposure of the bowel by the operation proves. The return of the contents of the gut depends on their fluid character, and on the tightness of the stricture, and is far less frequently effected than that of the fluid of the sac.

Violence in the use of the *taxis* is highly objectionable; instances have occurred in which the gut has been burst by it: one such case I have witnessed, and have known of others. Even when the injury is not so fatal, the violent squeezing to which a rupture is very commonly subjected damages its contents, especially if intestine be down, by the bruising which results therefrom, and renders the success of a subsequent operation very doubtful. I have seen several instances in which the gut presented large patches of *ecchymosis* which could have arisen from no other cause; and I believe that to this rough handling is mainly attributable the unsuccessful results of operations when the rupture has been long strangulated, and the *taxis* has been repeatedly employed with an unsparing hand. The reduction should therefore be attempted only with great caution, and with moderate and careful pressure. If after the warm bath and bleeding, the rupture cannot be reduced by the *taxis* applied not beyond half an hour, I think it is best to proceed at once to the operation, as least dangerous to the patient. Occasionally it will happen that, after the Surgeon's efforts have failed, the patient himself will succeed in returning the rupture; or he may suddenly become very faint, and the bowel return spontaneously, in consequence of the relaxation of the parts permitting the peristaltic action of the intestines within the belly, or some accidental movement of the body, acting upon the portion within the stricture, so as just to shift its place, which effected, the return soon follows, even without the application of ice, or any other remedy to empty the vessels of the part.

It sometimes happens in the efforts made either by the patient himself or by the Surgeon, to reduce a rupture, that instead of its contents merely being reduced, as in ordinary cases, the whole tumour, sac, bowel, and all, is thrust up into the belly, and the reduction seemingly effected, but the symptoms of strangulation still continue, and the patient dies; nor is it till after examination of the body that the cause of the mischief is found out. To this unhappy mode of returning a rupture the French Surgeons have given the names *Réduction en bloc*, or *Réduction en masse.* It appears to have been first noticed by Le Dran (*a*), in a man with femoral rupture, which had been reduced twenty-four hours after its strangulation. The symptoms, however, did not cease, but continued for a week, at the end of which Le Dran saw him; but he was too nearly gone to admit of operation, and died the same evening. The Surgeon first in attendance said, "that at the time of the reduction, he did not hear that noise the intestine generally makes when it enters into the belly; and that the parts composing the rupture passed in a heap under the ligament, like a tennis ball. * * * Upon opening the body we found the hernial sac in the belly, about three inches in depth, and eight in circumference, and within it was contained half an ell of the *intestinum jejunum.*" (p. 14) Le Dran directs in such case that "a cut should be made where the rupture was, and that the ring should be dilated or the ligament divided, in order to draw the sac back with the fingers, or a pair of forceps. The sac should then be cut open, its entrance dilated, and the intestine reduced. The sac cannot be far distant, since it is a part of the *peritoneum* that lines the inside of the *pelvis.*" (p. 21.) De la Faye (*b*) and Arnaud (*c*) confirmed Le Dran's observation by their own experience; but the fact was disputed by Louis (*d*) on account of the presumed connexion of the sac with the surrounding parts, and its large size rendering its return beneath the crural arch very difficult. Richter (*e*), however, defended the statement of Le Dran. Another case occurred to Scarpa (*f*), in a boy of thirteen, in whom the symptoms of strangulation continued after the presumed reduction of the rupture; "in fact, in the dead body of this boy there was not externally the smallest appearance of tumour in the inguinal region; but on opening the *abdomen*, it was immediately discovered that the intestine, still strangulated by the neck of the hernial sac, had been pushed up along with the sac beyond the ring, where it was seen rolled up between the aponeurotic *parietes* of the *abdomen* and the great sac of the *peritoneum.*" (p. 49; Engl. Edit. p. 143.) Sabatier, Dupuytren, and Sanson, have also had cases of this kind, and Dupuytren has had not less than six of them (*g*).

It is a very curious circumstance, that although these cases of reduced ruptures in mass, do not seem to have been very rare in France, yet till very lately they have been scarcely ever noticed in this country. Lawrence says:—"I have never seen a rupture reduced in a mass in this manner in the living body; nor have I seen any example of such a reduction in pathological collections." (p. 94.) And Key (*h*) observes:—"I have never known this to take place when the *hernia* has been reduced by the taxis." (p. 121.) Sir Charles Bell mentions (*i*) a case of this kind, in which "a tumour was discovered quite within the muscular walls of the *abdomen*, which proved to be the strangulated intestine within the peritoneal sac: so that the Surgeon had reduced the sac and the intestine within it; and the stricture which produced the strangulation being in the mouth of the sac, there was no relief, and the patient died." (p. 926.)

In the Museum of the Royal College of Surgeons there is an example of an inguinal rupture reduced in mass, and pushed between the abdominal and iliac muscles, and the *peritoneum*, part lying below the crural arch and extending outwards nearly as far as the external iliac vessels. It forms a considerable swelling inwards towards the cavity of the belly, but is not perceptible externally. The rupture was an old one, and the patient having worn a truss, was not inconvenienced by it, nor ever had difficulty in returning it, till it became strangulated.

Another case occurred in consultation to my friends Green and Callaway, in the year 1836, and to them I am indebted for the following particulars. The patient, it appeared, had several years before, whilst in Spain, had symptoms of strangulation and a swelling in the *scrotum*, which having been pushed up completely by a Spanish Surgeon, after a time the symptoms subsided; and he was not further inconvenienced until the attack now to be mentioned. On this occasion there was a swelling on the left side of the *scrotum*, irreducible but transparent, and accompanied with symptoms of strangulation. No relief was obtained by medicine, and it was determined to perform

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(*a*) Observations de Chirurgie, &c. vol. ii. 12mo. Paris, 1731.

(*b*) Opérations de Dionis. Fifth Edit., p. 324, *note* A. Paris, 1716.

(*c*) Traité des Hernies, vol. ii. p. 96.

(*d*) Mémoires de l'Acad. de Chirurgie, vol. iv. p. 299.

(*e*) Programma, in quo demonstratur herniam incarceratam una cum sacco suo reponi per annulum abdominalem posse, etc.

(*f*) Above cited.

(*g*) Dictionnaire de Médecine et Chirurgie pratiques,—Art. *Hernie*, vol. ix. p. 571.

(*h*) Above cited.

(*i*) London Medical Gazette, vol. xiii.

an exploratory operation. A cut was made into the swelling, the fluid evacuated, and the finger being introduced, readily passed in and turned freely about, and the intestines were felt, as it seemed, in the belly, and free from strangulation. The symptoms, however, continued, and the patient died four days after their onset. On *examination* it was found that the cavity, opened in the *scrotum*, did not, as supposed, permit the finger to pass directly into the general cavity of the *peritoneum*, but into a large sac lying between the iliac *fascia* and the *m. iliacus*, in which were contained intestines, and these were strangulated in a small aperture at the upper inner side of the sac, where was the communication with the cavity of the belly. The testicle lay behind the scrotal sac, just at the external abdominal ring. GREEN supposes that the rupture was originally congenital, and that when the patient was in Spain, the Surgeon had violently thrust up the whole rupture and the testicle into the belly, the sac doubling on itself; but that the intestine had then partially or completely relieved itself, and that afterwards the sac had lengthened downwards, forming the swelling filled with fluid which existed in the *scrotum*, and had been cut into.

The next case recorded, is that under BRANSBY COOPER's care in 1839, already mentioned, (*par.* 1117,) in which there were two sacs.

The attention of English Surgeons was certainly, however, scarcely drawn to the reduction in mass of a rupture, by the taxis, till LUKE's paper (*a*) was read before the Medico-Chirurgical Society, in the spring of 1843; and a perusal of the discussion thereon (*b*), clearly proves, that although it was attempted to show the subject had been previously well known, yet none of the speakers produced reference to any other than the few cases which I have already noticed, neither did any one allude to those of DUPUYTREN or SANSON. It must therefore be admitted, that LUKE is fairly entitled to the credit of having brought the subject fairly before English Surgeons, for although he has also availed himself of the experience of the French, he mentions not less than five cases which had come under his own notice, three of which were after death, and two he had under treatment, and gives account of; one of which would not submit to an operation and died, whilst the other was operated on and recovered.

The possibility of returning a rupture in mass, which had been doubted or denied, was clearly proved by JULES CLOQUET (*c*) in his experiments on the dead subject. He says:—"When the neck of the sac does not adhere very strongly to the aponeurotic opening, and the latter is also somewhat dilated, which is not uncommon, in pushing violently the rupture towards the cavity of the belly, the cellular adhesions of the neck, and of the aponeurotic ring lengthen and break; the two openings which were near, separate from each other; the former sinks, passing inwards, whilst the latter retains its place. Whilst the *taxis* is employed the cone above the neck of the sac on its abdominal side becomes very prominent and much lengthened, is no longer formed as in the former case, (where the neck of the sac adhered closely to the aponeurotic opening,) by the whole thickness of the abdominal wall, but merely by the *peritoneum* raised and detached from the muscles, by the sac which endeavours to get between those parts. The sac re-enters successively, and by little and little, through the aponeurotic ring as it dilates; and towards the end of the experiment it escapes suddenly, and gets behind this opening. It is then easily felt through the abdominal walls, by placing the finger on the spot which the rupture had occupied; it forms a large, hard, round, chestnut-like tumour deeply-seated above the ring. In this case the reduction is complete, the rupture has returned *en bloc*, and is situated between the abdominal *peritoneum* and the posterior surface of the aponeurotic ring. The ring contracts slightly, by its elasticity, as soon as the sac has entirely slipped over it, and to a certain point prevents the reappearance of the tumour externally. This reduction *en bloc* is sometimes followed by a slight rush, in consequence of the hasty passage of the bottom of the sac through the ring; but this rush never happens when the ring is very loose and wide. * * * When this last condition exists the tumour goes in and out with equal readiness. I have accomplished reduction in mass in about twenty-five instances, partly of ruptures either strangulated or otherwise irreducible, partly of empty hernial sacs. It is effected most easily in internal (direct) inguinal, then in crural, and lastly in external (oblique) inguinal ruptures. I have never succeeded in umbilical ruptures in adults. When the sac is of considerable size, when it adheres closely to the surrounding parts, when the aponeurotic opening is small, and in the form of a canal, circumstances which are frequently met with in external (oblique) inguinal ruptures, this kind of reduction is almost impossible, unless great force is employed. * * * The replacement in mass of a

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(*a*) Cases of Strangulated Hernia reduced *en masse*, with observations; in Med.-chirurg. Trans., vol. xxvi. p. 159.

(*b*) Lancet, 1842–3, vol. ii. p. 242–45.

(*c*) Recherches sur les Causes, &c. above cited.

rupture strictured by the neck of the sac, takes place most easily when the aponeurotic ring is of large size and short; when the sac and its neck are loosely connected to the surrounding parts; and when the protruded *viscera* adhere together, and to the sac, so that reduction in the usual way is impracticable. In a case of internal (direct) inguinal and in another of crural rupture, I found that the tumour could only be returned in a mass, although the neck of the sac was not narrow, in consequence of close adhesions between the protruded parts and their peritoneal covering." (p. 113–15.)

The following are some of the more important of LUKE's pertinent observations (*a*) in reference to the existence of a rupture reduced in mass, when without any tumour symptoms of strangulation are present:—"The too exclusive reliance upon the absence of tumour as a sign of the non-existence of a *hernia*, may, in certain cases, be highly dangerous. In suspected cases, more security will be derived from the institution of inquiries concerning the *previous existence* of a tumour in the part, and of its conditions when ascertained to have existed, such as its hardness, or the reverse, its freedom from pain, and also the amount of, and the manner of applying the force used for its reduction. By such inquiries, not only may the dependence of the symptoms of intestinal obstruction upon hernial strangulation be determined, but also the presumption of a reduction *en masse* may be raised or removed. Should such a presumption be raised, the Surgeon will then be prepared to push his inquiries further, and to seek for indications to direct his *diagnosis*, which are not usually sought for in ordinary examinations. The mode of proceeding to render these indications available to our use, is twofold. That, however, will in prudence be first adopted which requires mere manual examination without incision, while the second should be had recourse to, provided the first tends to strengthen the presumption of a reduction *en masse* previously raised. * * * It is a circumstance worthy of remark, that the firmness of the adhesions of the parts in which it is imbedded, bears no proportion to the duration of the hernial protrusion, as might be, *à priori*, expected; for in all the cases (of reduction in mass) related, the *hernia* had been of some years' continuance, yet in each was reduced without the employment of much force.

"The presence of sac, even without hernial contents, causes an abnormal fulness in the part, easily ascertainable by examination. The absence of such fulness in a part, when *hernia* is known to have previously descended, necessarily leads to the conclusion that the sac upon which it depended has been displaced, and probably returned, together with the *hernia*. The sac in inguinal *hernia*, below the external ring, becomes united with the spermatic cord, whereby the latter is usually rendered indistinct and obscure. The absence of that indistinctness and obscurity implies the removal of the cause which previously produced them, and, therefore, that the sac has been displaced. The continuance of the indistinctness and obscurity leads to a directly contrary conclusion. When a *hernia* descends from the *abdomen*, the aperture through which it descends is always enlarged and dilated. This fact is ascertainable by the introduction of a finger, a circumstance which becomes available to the *diagnosis* in these cases. Should a large aperture be detected, a previous hernial descent may be inferred. Under ordinary circumstances of *hernia*, when the contents are reduced into the *abdomen*, the area of the aperture is occupied by the remaining sac, while its margins are rendered more or less obscure. If, then, a large aperture be found free and unobstructed, with its margins unobscured, there is raised not only a presumptive evidence of the previous protrusion of a *hernia* at the part, but also the further evidence of the displacement and probable return into the *abdomen* of the sac by which the *hernia* had been invested. We are led to a contrary conclusion by contrary circumstances. These, I believe, are the only indications useful to *diagnosis*, resulting from changes caused by the previous descent of a *hernia*, at or below the abdominal ring.

"Nor does the examination of the inguinal canal afford any available information, unless a tumour be discoverable in its course; a circumstance which, by the clearness of the evidence it affords, renders the *diagnosis* comparatively easy, and affirmatively conclusive, but constitutes a description of case not intended to be included in the scope of the present observations, which are directed exclusively to cases unattended by any external appearance of tumour.

"Yet, in conducting an examination of the *abdomen*, immediately above the seat of the internal ring, some corroborative evidence of a reduction *en masse* may sometimes be obtained. Thus it may be expected, that if such reduction has been effected, the inflammation of the hernial contents will cause a circumscribed pain in the seat which it occupies, while a fulness, or even the rounded form of the *hernia* deeply situated within the abdominal *parietes*, may possibly be cognizable upon a minute examination;

(*a*) Cases of Strangulated Hernia reduced *en masse*, with observations, in Med-Chir. Trans., vol. xxvi.

yet the absence both of circumscribed pain, and of fulness or rounded form, should not lead to a negative opinion; for, in the first case, neither pain nor fulness existed, yet subsequently a mass of strangulated intestine was discovered at the part. Their presence, however, may be taken as corroborative of an affirmative opinion, founded upon the manual examination previously instituted.

"If circumstances justify a suspicion of a reduction *en masse* in any case, they will also justify attempts to cause reprotrusion of the tumour, that, by bringing it into view, the obscurity of the *diagnosis* may be wholly removed. With this intention, as advised by Surgeons of authority in such matters, the patient should be placed in the erect posture, and be requested to cough forcibly, to strain, and to make exertion. This course of proceeding seems likely to be of use when the hernial tumour is either in the inguinal canal or at the internal ring; but if it be reduced within the *abdomen*, as in the cases related, beyond the situation of the ring, the probability of affecting its reprotrusion will be much diminished, and consequently an opinion of the non-existence of a reduction *en masse*, drawn from the non-appearance of a tumour, is to be cautiously avoided."

Although, after "the most rigid local manual examination, the indications afforded for our guidance are so obscurely marked," as to afford "a sufficient explanation why Surgeons, under these circumstances, are usually unwilling to have recourse to ulterior measures of examination, by submitting the patient to the certain pain and possible danger of an exploring operation, yet such unwillingness may prevent the adoption of the only means of preserving the patient's life. As the doubts and difficulties of such cases can be removed only by the light which an operation of exploration affords, it is the obvious duty of the Surgeon to make that unwillingness yield to the pressing emergencies of the occasion. * * * It should be remembered that an unsuccessful attempt is infinitely to be preferred to no attempt at all, and that passiveness on his part may be more destructive to life than any incisions which he may be required to make." (p. 175-79.)

With these observations of Luke I most fully concur, and more especially, because there appears to be pretty good grounds for finding the reduced rupture at a particular spot, as Dupuytren (*a*) observes:—"When the hernial tumour is reduced in mass it cannot move about in the belly, because it is formed, in part at least, by the *peritoneum*, which although movable, remains always in the region to which it belongs, and consequently retains the tumour. The rupture is then permanently behind the opening, by which it has returned and resting on its internal surface. Surrounded by the cellular tissue, which had previously united the *peritoneum* to the wall of the belly, and which has been displaced to receive it, the returned tumour is found, besides, to be covered with a second layer of *peritoneum*, which is actually that detached from the hind surface of the belly; so that to penetrate the hernial sac, by cutting through the abdominal wall, the *peritoneum* must be twice cut, and its cavity opened before reaching the cavity of the sac, unless the operation were performed like that for tying the external iliac artery, by raising and detaching the serous membrane. Dupuytren does not, however, advise either cutting through the *peritoneum* and opening the abdominal cavity, or turning off that membrane to get at the hernial sac. "There is fortunately," says he, "a more simple and less dangerous mode of treatment, which consists in seeking for and drawing down the rupture by the opening through which it had passed into the belly, being assured it will be found resting on the internal surface of that opening, where it can be laid hold of with the forceps, and drawn out, with or without cutting the edge of the ring. If the tumour be examined through the cavity of the *peritoneum*, it will be seen lodged in the iliac pit, a little more outwards in crural rupture, a little more inwards and deeper in inguinal rupture. It presents a narrow, tight opening, in which the two ends of the intestine are plunged, forming a loop in the cavity of the sac. It is at this point that the intestines are compressed, narrowed, shrunk, strangulated, and mortified, the upper end more frequently than the lower; the former bulges almost to bursting; the latter, shrunk, empty, and like the intestine of a child." (p. 592-94.)

"In conducting operations of exploration," observes Luke, "the indications which are to be sought for, are, for the most part, of a similar nature to those already mentioned, as useful in the manual examination. They are, however, more satisfactory and distinct, inasmuch as the parts to be examined are, by our incisions, brought immediately into view, and are not obscured by the interposition of superjacent structures. Thus by the perfect exposure of the external inguinal ring, * * * if the size of the ring be normal, a *hernia* has not descended through it; or if it be larger than the normal state, yet occupied by an empty sac, an evidence of the previous existence of a *hernia*, together with an evidence of the reduction of the *hernia* without the sac being also reduced, is established. But should the ring be found large and free from other obstructions than the cord, and if the

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(*a*) Above cited.

cord be distinct and unobscured by the presence of a sac, and a void is found where fulness is to be expected from the previous history of the case, a strong presumptive evidence on the contrary side is established, that the *hernia*, together with its investing sac, is reduced.

In proceeding with the exploration, the inguinal canal is next laid open. * * * I hold a close observance of the condition of parts within the canal to be a matter of very great importance. It will be recollected that the ordinary oblique inguinal *hernia*, during its passage through the canal, lies anterior to the spermatic cord. The hernial sac, when left empty after the reduction of its contents, occupies the same relative situation, and consequently overlays and obscures the cord after the canal is laid open. If the reverse of this is found in a case where a hernial descent is known to have previously existed, and the cord is ascertained to be clearly and distinctly brought into view, throughout the whole extent of the canal we may justly conclude, that the distinctness and clearness with which the cord is seen are caused by the removal and consequent reduction of the hernial sac from over it, which reduction can be effected in no other direction than into the *abdomen*.

" The condensed cellular capsule (usually found) immediately investing the sac * * * has but little connexion with the sac, and will remain even when the sore has been reduced. * * * If found and ascertained to be empty, the circumstance is of a very conclusive character, and moreover will afford a direct clue to the situation of the *hernia*. A finger introduced through an opening made in such capsule, will be conducted towards or through the internal ring, beyond which it will be brought into contact with the hernial tumour itself, having in the introduction passed through the same channel by which the reduction was effected.

" The indications to be noticed at the internal ring are of a similar nature to those mentioned as being found at the external ring, and relate to the size of the aperture and the structures by which it is occupied.

" It will be observed that up to this period the proceedings of the exploration have been conducted without any danger of importance, and without any necessary disturbance to the *peritoneum*, yet information of the most conclusive kind may have been obtained, and such circumstances brought under notice as could fully justify the operation, even if manifold, more hazardous than it really is. * * *

" The operation may be conducted to a demonstrative conclusion, by ascertaining the existence or non-existence of a hernial tumour, without adding materially to the trifling danger already incurred. This is accomplished simply by the introduction of the finger through the internal ring, and by passing it from side to side. Should a hernial tumour be present, it will at once be recognised, and found lying externally to the general peritoneal membrane, although within the *parietes*, and presenting a rounded surface. Should a tumour be not present, the circumstance may be ascertained by observing the smooth surface of the *peritoneum*, and the continued adhesions which it maintains with the *parietes* immediately surrounding the ring. If doubt still exists, an enlargement of the internal ring, by division of the adjoining *transversalis fascia*, will afford a clearer exposition of parts, and a more decisive evidence for either an affirmative or a negative conclusion; and thus an exploration may be conducted to its termination without the necessity of any peritoneal section.

" When the doubts have been resolved in the affirmative, by the discovery of a hernial tumour, the tumour may be brought into the inguinal canal, so as to occupy its former situation before reduction, by enlarging the ring to the requisite extent for its passage. It may afterwards be opened, and its contents dealt with according to their condition, as under the ordinary circumstances of common operations. * * *

" The sac should, in all circumstances be opened, and its neck freely divided, so as not to leave any impediment to reduction of its contents into the general peritoneal cavity. It should be recollected also, that the adhesion of the sac to the surrounding parts has been severed, and that consequently, the sac will be liable to be again reduced during the reduction of the contents into the *abdomen* unless caution be used for its prevention. The danger of this occurrence may be always obviated by the introduction of the finger through the neck of the sac, after the contents have been reduced, for thus the fact of their perfect liberation may be readily ascertained." (p. 180–85.)]

1145. If the rupture be completely reduced, which can be determined by introducing the finger into the abdominal ring, its re-descent is to be prevented by continual suitable pressure, which is to be made by proper bandages, *Trusses*, (*Bracheria*, Lat.; *Bruchband*, Germ.; *Brayer*, Fr.,) upon the hernial opening.

Upon the subject of Trusses, see

Camper; in Mémoires de l'Académie de Chirurgie, vol. v.

Javille's Traité des Bandages Herniaires. Paris, 1786.

Brünninghausen, Gemeinnütziger Unterricht über die Brüche dem Gebrauch der Bruchbänder und über das dabei zu beobachtende Verhalten. Würzburg, 1841; with one Plate.

Lafond, J. J., Considérations sur les Bandages Herniaires usitées jusqu'à ce jour, et sur les bandages renixigrades ou nouvelles espèce de brayer. Paris, 1818.

Döring, Art. *Hamma*; in **Rust**'s Handbuch der Chirurgie.

Cooper Astley, above cited, p. 21.

Cloquet, Art. *Brayer*; in Dict. de Médecine, vol. v. 1834.

1146. *Trusses* are either *elastic* or *inelastic*. The latter consist of a strap of fustian, leather, or the like, and of a *pad*. When applied, they may not yield to the movements of the coverings of the belly, may therefore be very easily displaced, the intestines slip from them, and if this be prevented by drawing tight, painful pressure is produced. Upon these grounds the inelastic trusses are to be altogether rejected.

1147. *Elastic trusses* consist of, *first*, a *spring*; *second*, a *pad*; and, *third*, of a circular *strap*. The *spring* is a narrow flat piece of well-hardened steel, which bends in a semicircle around the diseased side. A plate of steel is attached in front to the spring and its inner surface padded with wool or horse-hair, so that it may form a soft but regular arching, this part is called the *pad*. At the hinder end of the spring is a circular strap, which passes round the other side of the body, and is fastened to a button on the outer surface of the pad. The whole truss is to be covered with soft leather and lined on the inside, so that it may not make any troublesome pressure.

1148. The truss must be made with great care in each of its parts, and be fitted to every individual case. The *strength of the spring* must correspond to the resistance which it has to afford, and fit well to that side of the body on which it is applied. The *pad* must have a *size* corresponding to the bulk of the rupture, and the *angle* at which it stands from the spring correspond to the surface on which it is applied, which it has been also attempted to effect by a *movable pad*, in order to suit it to every case. The *pad* must not be *too soft* nor *too hard*, and its convexity must be such that it may be regularly over the whole hernial opening; pads of hard wood, ivory, or filled with air, (**Cresson** and **Sanson**,) are less certain and suitable. If the circular strap alone be insufficient to keep the truss in its proper place, we must endeavour to prevent its displacement by a second strap, carried between the thighs.

In order that the truss may be sufficiently firm, it is necessary in every case to take the size, by means of a bandage carried round the body from the seat of the rupture and in the direction on which the truss is to lie; or for the same purpose, a double piece of flexible wire may be used, with which the necessary curve can be given; about an inch must be added to the size on account of the covering of the strap.

1149. The truss is to be applied after the proper use of the *taxis* for the reduction, whilst with the fingers the intestines are kept up, till the pad be properly applied on the hernial opening, and the strap be fastened. The patient should then cough, and stand up, to determine that the truss is not put on too tightly and that the parts are well kept up. The Surgeon should always apply the truss the first time; subsequently the patient may do it himself, but it should be whilst lying on his back and early in the morning; he should also have several trusses for the purpose of change. The part on which the truss rests should be frequently washed with brandy, till the teguments are accustomed to its pressure. If excoriations occur, the parts should be washed frequently with lead wash, whitelead should be strewed over it, and a thick piece of linen applied beneath the truss.

1150. Various diseases in the neighbourhood of the opening upon which the pressure must be made, and an imperfectly reduced rupture may prevent the use of the truss. Large ruptures are extremely difficult to reduce, and often new ruptures occur afterwards in other parts. In children the use of an elastic truss is not only acompanied with no injury, as many suppose, but it is to be preferred to the use of an inelastic one.

1151. When an adhesion prevents the return of a rupture to such extent that part of it remains external, a truss with a hollow pad may be used; but in very large irreducible ruptures a suspendor sufficient to enclose it, should be used to prevent the further protrusion of the intestine. In these ruptures the gradual return is effected by long-continued lying on the back, by slender diet, purging, frequently cold applications over the rupture, and by daily repeated attempts at reduction, which has occurred to me in several cases of very large and adherent ruptures. When in large ruptures the walls of the belly are so contracted that the parts in the rupture have scarcely any room in the belly, the same treatment is indicated. Frequently in such cases, after the reduction and the application of a truss, anxiety, oppression, pain, small pulse, and so on occur, and it becomes necessary to remove the truss, after which the symptoms, as I have observed, subside.

1152. When the intestines are properly kept up by the truss, the hernial sac gradually contracts, and at the same time a slow inflammation arises, consequent on the pressure of the truss, by which perfect adhesion of the neck of the hernial sac takes place, and thus a *radical* cure is effected. This commonly happens in children, frequently in adults, but never in old persons. On account of this gradual narrowing of the neck of the hernial sac, under the continued use of the truss, the latter may not be again removed if it be not believed certain that the radical cure is effected; because otherwise, in repeated protrusions of the intestines, strangulation may also arise from the contracted neck of the sac. Whilst the patient wears the truss he must avoid all violent exertion.

[Cloquet considers that a hernial sac may be returned spontaneously into the belly in four different ways. *First*, by the contractility it possesses in common with other tissues, having a constant tendency to retract the sac upon itself, after its distension, and which is, in some cases, sufficient to produce a gentle and gradual return. "The sac then takes a retrograde movement to that of its formation; the *peritoneum* passes from the ring towards the parts it had left, that portion of this membrane, which had been drawn towards the ring without passing through it, pulls the neck in every direction, which expands, turns out in some degree, disappears, and at last is effaced; the sac unfolds, and again covers the wall of the belly, near the aponeurotic opening. The neck of the sac, which was last formed, disappears first, whilst its bottom disappears last, and with great difficulty, so that the reduction is often incomplete." (p. 74.) When a rupture has been thus reduced, the remains of the neck are sometimes observed at a little distance from the ring, in the shape of irregular *stygmata*, whitish, and more or less opaque. The *peritoneum*, which formed the sac, is restored to the abdominal wall. * * * Sometimes these sacs are so completely effaced, that no trace of them can be found in the *peritoneum* covering the ring by which they had escaped. The only indication of a rupture having existed at this spot, is a cellular, whitish, empty pouch, arising from the aponeurotic ring." (p. 76.) *Second*, "by the closing, the gentle and insensible contraction of the cellular tissue external to the sac. The other tunics may concur also; but their action appears more weak, and less demonstrable. * * * In this case the *peritoneum* presents at the top of the ring irregular, prominent folds, analogous to those of the mucous membrane of the stomach during the contraction of its muscular coat." (pp. 78, 9.) *Third*, by the displacement of the *peritoneum* from the abdominal wall from various causes, as in two cases of direct inguinal rupture, in which, in consequence of retention of urine, the *peritoneum* covering the bladder was raised nearly to the navel—by enlargement of the womb by pregnancy, or any other cause—by adhesion of the *omentum*, or intestine to the hernial sac—by a large quantity of fat collecting between the *peritoneum* and wall of the belly—or by the dragging of another sac which has formed in the neighbourhood of the former. *Fourth*, by the contraction of the cremaster muscle; "the two fleshy bundles of which act upon the sac pretty much as the two bellies of the digastric muscle effect the direct elevation of that bone." (p. 83.)]

1153. The *radical cure* of reducible ruptures (especially inguinal ruptures) was attempted in ancient times in very different and in part cruel and barbarous ways, which had only their corresponding excuse in the ignorance of, or in the bad construction of trusses. Even later modes of treatment have found little favour, on account of the danger therewith connected, and because of the more perfect construction of trusses; and only of late have these objects again attracted more attention, and less dangerous methods of treatment have been proposed. All the modes of treatment in reference to the radical cure have for their object the organic closing of the neck of the hernial sac, or of the abdominal ring, or to effect both at once, which has been attempted by a sufficient degree of *adhesive* or *suppurative inflammation*, and thereby causing *adhesion;* or by a *plug of skin healed into the abdominal ring*. These may be collected together under the following heads: *first*, Increased pressure whilst lying constantly on the back, with, or without the simultaneous application of irritating and contracting remedies; *second*, Caustics and the actual cautery; *third*, Ligature of the sac, with or without cutting it off; *fourth*, Introduction of foreign bodies into the hernial sac; *fifth*, Healing-in of a detached portion of skin, or of a portion of infolded skin, into the abdominal ring.

1154. Increased pressure, whilst the patient lies constantly on his back, heretofore employed by FABR. HILDANUS, BLEGNY, WINSLOW and others, has of late been recommended by means of a common pad, (RICHTER and others,) with a conical linen pad, the point of which is inserted into the abdominal ring by means of an elastic truss; the supine posture is to be continued at least four weeks, till superficial ulceration take place, which should be dressed with lead cerate, and the truss still applied tightly for some time (LANGENBECK) (*a*); at the same time a sponge dipped in turpentine, or a blister, is to be put on beneath the pad (BOYER); with a pad of which the power can be increased by means of a compressing screw, with a pressure apparatus moistened with alum wash (RAVIN) (*b*); or with a pad filled with contracting herbs, and subcarbonate of ammonia (BEAUMONT) (*c*).

Various irritating and astringent remedies have been mentioned which have been employed in blisters, bags, pads and as washes; to wit, bark, tormentilla, gall nuts, oak bark, rhatany, alum, turpentine, ætherial oils, naphtha, washing with cold water, iron bullets, cold river bathing, and so on. JALADE LAFOND (*d*) employs a pad with a reservoir for holding caustic.

1155. The application of the *actual cautery*, derived from the Alex-

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(*a*) Abhandlung von den Leisten und Schenkelbrüchen, p 121.

(*b*) Essai sur la Théorie des Hernies et de leur étranglement, et de leur cure radicale. Paris, 1822.

(*c*) Notice sur les Hernies et une nouvelle manière de les guérir radicalement. Paris, 1827.

(*d*) Remarques nouvelles sur la cure radicale des Hernies simples sans opération sanglante. Second Edition. Paris, 1841.

andrian school and first described by PAULUS ÆGINETA, and of *caustic* (recommended from early times, from AVICENNA up to KERN) closes the hernial opening by destroying the skin and hernial sac, and forming a hard scar connected with the bone. After the rupture has been returned, and the cord drawn aside, the cautery is to be kept so firmly upon the abdominal ring, that it burn deeply through the skin and hernial sac down to the bone. In the same way caustics are to be applied, viz., caustic potash, arsenic or sublimate with opium, lime, sulphuric acid, one part of caustic potash, two of gum-arabic, and some water (KERN.) The cautery as well as the caustics have also been applied upon the hernial sac laid bare by incision (FRANCO, MONRO.)

1156. *Tying up the hernial sac* with the *ligature* (*ligatura sacci herniosi*, Lat.; *Zusammenschnürung des Bruchsackes*, Germ.) and *stitching* (*sutura*, Lat.; *Naht*, Germ.) are performed in different ways: *first*, after the already directed reduction, encompassing the sac with a needle and tying together both it and the spermatic cord with a ligature; *second*, after previously laying bare the sac by an incision, encompassing the hernial sac and the spermatic cord with a needle, and introducing a golden thread which can be so drawn as to close the hernial sac, but the spermatic cord is not to be compressed, (the *golden puncture*, *punctum aureum*) (BERARD, FRANCO); *third*, tying the hernial sac and the spermatic cord, and cutting both off below the ligature, or first cutting off both and then tying them (the *rupture-cutter* of the middle ages); *fourth*, separation of the hernial sac from the surrounding parts, and then tying it with a leaden thread, (PARÉ,) or closing it with the glover's stitch, the royal stitch, (*sutura regia*,) (NUCK, FABR. AB AQUAPENDENTE, GUY DE CHAULIAC, and others,) or simple tying with a waxed treble or quadruple thread. (LE DRAN, FREITAG, SENFF, SCHMUCKER, THEDEN and others,) in modern times LANGENBECK and KERN, the latter of whom, in omental rupture, tied the exposed *omentum* near the abdominal or femoral ring, so that the remaining part of the *omentum*, by uniting with the walls of the ring, closed it up; *fifth*, incision into the integument and hernial sac, and treating as after the operation for strangulated rupture, with simple lint dressing and light pressure with a spica bandage or truss, (PETIT, LIEUTAUD, LEBLANC,) or with simultaneous scarifications of the hernial sac, (FREITAG, MAUCHART, RICHTER,) or with the introduction of tents of lint (DIONIS, MERY, ARNAUD, SCHREGER, VON GRAËFE, VON WALTHER and others.) Here also belongs the injection of red wine, recommended by SCHREGER, and the inflation of air into the hernial sac, the mouth of the sac being carefully closed with pressure.

1157. The *inhealing of a plug of skin*, to close the mouth of the sac, is effected in two ways:—1. According to DZONDI's proposal (*a*), to heal within the abdominal ring, purposely wounded a sufficiently large fold of skin, formed by an incision of the skin; JAMESON (*b*) made, in a femoral rupture, a fold of skin two inches long, and an inch wide, thrust it into the femoral ring, and united the edges of the skin with stitches. 2. GERDY's inhealing of the skin, ensheathed in the inguinal canal (*c*). After the patient is placed, as in the operation for strangulated rupture, a finger of the left hand, smeared with cerate, is to be placed somewhat

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(*a*) Geschichte des klin. Institutes zu Halle. p. 117.

(*b*) The Lancet, vol. ii. 1829, p. 142.

(*c*) Bulletin de Therapie, 1835.—FINK, Ueber radicale Heilung der Brüche. Freiburg, 1837; with two copper-plates.

beneath the hernial opening on the *scrotum*, and then the *scrotum* in front of it is to be thrust along the spermatic cord as deeply as possible into the inguinal canal. In this blind sac the finger is to remain, and the skin is to be thrust as far as possible towards the outer wall of the inguinal canal. A curved needle, with two cutting edges, and with a handle, and its eye armed with a double thread, is then to be introduced, on the palmar surface of the forefinger, to the bottom of the ensheathing, and whilst the handle of the needle is depressed, the needle itself, its convex surface resting on the palmar surface of the finger, is to be thrust, whilst an assistant presses the external skin against its point, from behind, forwards through the front of the ensheathed part of the *scrotum*, and the front wall of the inguinal canal, so that the needle projects some lines above the inguinal ring. The one end of the thread is now to be drawn out, and given to an assistant, the left finger still remaining in the ensheathing. The needle, in the eye of which the other end of the thread remains, is now again to be passed upon the finger, at some lines' distance from the former stitch, thrust through externally, and the thread withdrawn from it. After the removal of the needle, the threads are to be divided, and a cylinder of plaster placed between them, upon which they are to be tied, and the ensheathed part of the *scrotum* is firmly retained in its place. If the entrance and canal of the rupture be much enlarged, two other stitches must be applied; but in general, one is sufficient. The sac formed by the ensheathed skin, is to be then pencilled with caustic *liquor ammoniæ*, to excite inflammation, the part operated on covered with a pad, spread with cerate, and covered with a compress, and the patient put to bed in such position, that the rump and the head are somewhat raised, and the thighs drawn up. In all cases phlegmon follows, which spreads over the whole extent of the stitches, and runs into suppuration, the *pus* discharges itself through the stitches, along the threads, which, at the same time, also act as guides to it. If the adhesion have taken place in from three to five days, the stitches may be removed. Towards the fifteenth or twentieth day, the suppuration ceases, the ensheathed skin forms a plug, which externally appears like a swelling, but gradually subsides. The patient must, for four weeks, observe the supine posture, and the treatment must be conducted according to the inflammatory symptoms which may come on. SIGNORONI (*a*) thrusts up the skin, like the finger of a glove, into the sac of the rupture, and fixes it by means of a female catheter, then pierces it with three long hare-lip needles, four lines apart from each other, and twists around each an ∞-shaped thread. The needles are left six or eight days. WÜTZER (*b*) retains the skin thrust up into the inguinal canal, by means of a cylinder, on the under part of which is fastened a plate which fits the outer surface of the inguinal canal. A needle is thrust through the upper part of the cylinder, outwards, and brought out by an opening of the external plate.

Here must also be mentioned GARENGEOT's proposal, according to the experiment once made by PETIT, that strangulation existing, if the mouth of the sac were expanded with one wound, and the opened hernial sac thrust back into the belly, the radical cure followed; this treatment might also apply to the attainment of the radical cure, as well also as the reduction of the exposed sac according to HUMMEL and STEPHENS.

[(1) BRANSBY COOPER (*c*) has performed GERDY's operation. The application of the caustic ammonia caused intense pain in the part, for a few hours after the operation,

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(*a*) Bulletino Medic. de Bologna, 1836, Dec. FRORIEP's neue Notizen, vol. ii. p. 272.

(*b*) Organon für die gesammte Heilkunde, vol. i pt. 1.

(*c*) Guy's Hospital Reports, Oct., 1840, p. 270–75.

but no pain in the belly. On the fourth day, suppuration having been freely established, the ligature was removed, but the pressure was continued. On the fifth day, there appeared a degree of fulness about the margin of the opening, as if a portion of the inverted skin had descended, but without any descent of the intestine, and the hardness and swelling about the inguinal canal still led to the reasonable hope that the operation would prove successful. After some days, as the tenderness diminished, greater pressure was made. On the twenty-fourth day, a weak truss was applied, and he continued in bed ten days longer, after which time however he would not be confined, but got up and walked about, and soon after left the hospital. But he had a slight return of the rupture.]

1158. The most modern practices which may be placed next the former, are those of Bonnet, Mayor, and Belmas.

Bonnet (*a*) employed the same treatment as for *varicocele*, introducing needles upon the hernial sac, and allowing them to remain. The rupture having been reduced, the *scrotum* is to be grasped with the left hand, as close as possible to the abdominal ring, and the spermatic cord brought into the circle formed by the thumb and forefinger of this hand; a pin, with a piece of cork on its head, is to be thrust, close to the suspensory ligament of the *penis*, from the point of the finger nearest it, from behind and above, forwards and downwards, through the integuments and the hernial sac. A second piece of cork is to be fixed on the projecting point, and brought near the first piece, so that the intermediate soft parts are easily compressed; and in order to keep the second piece of cork in its place, the point of the pin is bent down. The spermatic cord is to be placed between this pin and the tip of the thumb and forefinger of the left hand, and a second pin is then introduced six lines distant externally from the first pin, parallel to it, and fastened in the same way. If the spermatic cord have been divided by the pressure of the intestine, into its several parts, a third pin must be passed, six lines from the second, so that the other parts of the cord may be placed between the second and third pins. Usually, about the fourth day, pain and inflammation come on; but the pins are not to be removed till the inflammation has acquired a certain degree of intensity, and the hindmost piece of cork has excited ulceration of the skin, which occurs about the sixth, or even at the twelfth day. By this proceeding, not merely is the hernial sac, but also the abdominal ring closed, and united with the neighbouring parts by the effused lymph.

Mayor (*b*) has modified this practice, by forming at the abdominal ring a *longitudinal fold of skin* varying in size according to the bulk of the rupture and the width of the abdominal ring, to the middle of which corresponds a line drawn over the middle of the hernial swelling; through the base of this fold of skin, held up by the fingers, a needle, armed with a double thread, is to be passed, the ends of which being separated on each side, are to be tied on a piece of bougie, or on a piece of cotton, or of sponge properly tied together. The number of stitches is determined by the size of the fold. In children the first stitch is to be made over the middle of the abdominal ring, at other times, the stitches may be commenced where you please. If the abdominal ring be wide, and the other circumstances unfavourable for contraction and keeping up the rupture, it is then necessary to bring the stitches nearer, and to increase the size of the substances which are held together by the threads. In slight cases, and with quiet, intelligent patients, no bandaging is used; slight compression

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(*a*) Journal des Connaissances Medico-chirurgicales, 1836, July.—Gazette Médicale, 1836.

Plachetsky, F., Ueber die Bonnet'sche Radical operation der Hernien nebst 8 Krankheitsfällen; in Beiträgen zur gesammten Natur und Heilwissenchaft herausgeg. von Wertenweber, vol. vi. pt. i.

(*b*) Sur la cure radicale des Hernies. Paris, 1836.

upon a thick layer of wool by means of a fitting truss, or a neckerchief fastened upon the hip, is always requisite, especially in children and restless patients, and in large ruptures which are with difficulty kept up. The threads may be removed from the sixth to the ninth day, and a truss must be worn for a shorter or longer time afterwards.

1159. Belmas (*a*) attempts to effect merely adhesive inflammation, by introducing goldbeater's-skin into the hernial sac, which he at first passed in, as an empty, dry bladder, by an incision through the sac, and then inflated it; but of late he has pursued the following plan:—After the rupture is completely returned, the sac and its coverings are to be raised with the fingers of the left hand in one fold, in front of and parallel with the spermatic cord, and through its middle, above the abdominal ring, a trocar-like instrument, divisible in the middle, is to be thrust. The operator now allows the hernial sac to slip from between his fingers, so that the fold is formed by the skin alone. An assistant holds this fold, and whilst the hernial sac is fixed by the thumb and forefinger, applied above and below the instrument, the latter is to be thrust forward till the union of the two canals corresponds to the interspace between the walls of the hernial sac. By the peculiar mechanism of the instrument the two canulas, after the removal of the trocar-points, are drawn asunder, and both walls of the hernial sac separated. The assistant lets go the fold of skin, grasps the canula corresponding to the trocar-point, whilst the operator holds the other canula, and through its aperture introduces with a probe four or five thin cylinders of jelly covered with goldbeater's-skin, in various directions, into the neck of the hernial sac. The canulas are then removed, and a truss is put on, the pad of which acts where the cylinders of jelly are placed, and is to be worn at least for four months, constantly. The patient may after the operation follow his business. The cylinders of jelly are soon absorbed. The goldbeater's-skin resists absorption longer, and excites slowly in the hernial sac an adhesive inflammation, which is confined to the parts in immediate connexion with the foreign bodies.

Walther's proposes to inject animal fluid, the patient's blood, into the hernial sac.

Upon the Radical Cure of Rupture, compare also

Ran, Dissert. de novo hernias inguinales curandi methodo. Berol., 1813.

Pfefferkorn, Diss. de herniis mobilibus radicitus sanandis. Landishut, 1819.

Pech, Osteosarcoma ejusque speciei insignis descriptio; adjuncta est de cura herniarum per ligaturam tractatiuncula. Wirceburg, 1819.

Hesselbach, A. K., Die Lehre von den Eingeweidebrüchen, vol. ii. p. 214.

Thierry, A., Des diverses méthodes opératoires pour la cure radicale des Hernies; Thèse de concours; avec des Planches. Paris, 1841.

1160. The decision as to the performance of the radical cure for reducible rupture in general, and on the different modes of treatment in particular, must be guided by the following circumstances. In consequence of the very greatly improved construction of trusses of late years, the necessity for the so-called radical operation is, in comparison with former times, quite another thing, as thereby every reducible rupture can be retained in its proper place, and a cure often be effected by the proper wearing of a truss. All the modes of operation mentioned are more or less dangerous, especially cauterizing, tying, and stitching up the hernial sac, and the

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(*a*) Recherches sur un moyen pour déterminer des inflammations adhésives dans les cavités séreuses. Paris, 1829.—Cliniques des hôpitaux de Paris. 21st Aug., and 11th Sept. 1839.—Revue Médicale, March, 1838.—Von Walther, Ueber die Herniotomie als Mittel zur radicalen Heilung der Brüche; in Journal für Chirurgie und Augenheilkunde, vol. xxvi. pt. iii. p. 363. (Engraving of the Instrument.)

introduction of tents, as the inflammation thereby excited quickly spreads over the whole of the *peritoneum* and the intestines. Therefore, also, many of the earlier adherents to this or that practice, have, after unfortunate results, given them up entirely; and although some, for instance, Kern, have always observed fortunate results, and only one case terminate fatally, yet these assertions are too greatly opposed to the experience of others, to enable us to yield them entire belief. All the modes of treatment, at the same time, in reference to their *permanent* consequences, are uncertain, and the statements of the cures are confined principally to immediately after the operation. Although the external abdominal ring and a part of the neck of the hernial sac be loosed, there remains (in external or oblique inguinal rupture) the opening of the internal abdominal ring into which the intestines again enter, and by gradual subsequent absorption of the effused plastic mass, and the thinning of the scar resulting therefrom, the rupture enlarges outwardly. In many cases, if the enlargement of the opening out of which the vessels of the testicles and thighs protrude, be the consequence of a bad, lymphatic constitution, apertures are formed in other parts of the belly, and if the rupture be kept up at one part, it will be seen to project at some other part. In gouty, otherwise healthy subjects, in a small rupture of not long continuance, if the sac be not thickened and not united to the neighbouring parts, the result may be at first favourable. Increased pressure, with the supine posture, is of all treatment the least dangerous, and may be attempted in all cases, although even herewith, severe inflammation and gangrene (Manget, Richter) and even death (Wilmer, Schmücker) have been observed. As to this mode of treatment, the methods of Gerdy, Belmas, and Mayor, are arranged according to their less danger. Gerdy has up to the present time had the greatest success; I have, however, seen a recurrence of the disease, and according to Breschet (*a*), the results have in several instances been unfortunate. If, as in old ruptures where the sac adheres to the aponeurotic opening, (the abdominal and femoral ring,) and consequently a mere inthrusting of the skin be not possible, the hernial sac be thrust in and held with loops, dangerous inflammation may easily occur; and this is still more likely to occur, if, as in Bonnet's practice, be adopted. In this respect Mayor's treatment is least attractive. I consider as some of the indications for the so-called radical cure those reducible ruptures, which even in the above-mentioned supine posture, with the application of a truss, cannot be certainly kept up, especially in young persons, Gerdy's or Mayor's treatment is the most proper; but a truss must always be worn subsequently. The possibility of an unsuccessful, and the probability of a not permanent result must not be withheld from the patient's knowledge. The patient's wish to be cured *radically*, at all hazards, and to get rid of the use of the truss must not, according to the hitherto noticed results, determine the Surgeon to operate.

Opinions in reference to the value of the radical operation for reducible rupture, are in modern times much divided, many rejecting it as dangerous and ineffectual, (Boyer, Dupuytren, Lawrence, and others,) and it has been attempted to be effected by continued pressure alone (Richter, Langenbeck, Zang.) Few have allowed its general employment (Kern, von Graëfe.) Some confine it to certain cases (Schreger, Von Walther, and others.) Schreger especially lays down the following indications:—1. To remove certain local conditions and to render the application of a truss possible, for instance, in the complication of inguinal rupture with hydrocele, and indeed

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(*a*) Journal von Graëfe und von Walther, vol. xxii. pt. iv. p. 657.

in a common hernial sac; in young subjects, with large ruptures, which cannot be properly kept in their place by any truss; in partial adhesions between the protruded parts and the hernial sac, or the testicle in congenital rupture. 2. In very fat or thin persons in whom the truss always shifts, for the purpose of restricting by the operation, the protrusion of the rupture, and thereby to strengthen the effect of the truss. 3. When scarcely any truss will fit; for instance, in lame persons, or if the testicle lie completely in the groin. 4. Questionable femoral ruptures, because in these there is little benefit from insecure application of the truss, and the danger being greater in existing strangulation. But in all these cases, the rupture can be kept up by the proper construction of the truss, and its application in the supine posture. If hydrocele exist at the same time, repeated puncturing answers the purpose better (*a*).

[English Surgeons have rarely employed either of the methods proposed for the radical cure of ruptures, except the constant application of a truss, which, however, is admitted to be rarely successful, except in young persons and very recent ruptures. Astley Cooper removed the entire sac in a case of femoral rupture, and "passed stitches through its mouth, so as to bring the edges into perfect contact. * * * On the sixth day the ligatures came away, and the wound was healed on the tenth. A month afterwards I saw the woman," says he, "and was surprised to find that another *hernia* had formed on the same spot, which was already as large as that for which the operation was performed. * * * It appears, therefore, that the removal of the sac will not prevent a return of the disease; and, indeed, when it is recollected that the aperture from the *abdomen* continues of the same size after, as before the operation, and that the *peritoneum* will still remain the only obstacle to the descent of the intestine; it does not appear probable that this highly extensible membrane should succeed in preventing a return of the same *hernia*, the just formation of which it was unable to resist." (p. 62.) Astley Cooper objects to the plan of making a ligature round the mouth of the hernial sac, not only that its object, gradually to cut away the sac, is inefficient, as shown in the preceding observation, but also because "it cannot even be securely done; for *first*, the spermatic cord is often divided by the sac, so that one part of it passes behind, and the other before, or on the side of the sac. When this happens, it would be extremely difficult, if not impossible to conduct the operation in such manner as to avoid injuring parts which should never be touched. *Secondly*, this operation is founded on mistaken ideas of the hernial sac; for a ligature applied as proposed, at the abdominal ring, if it cut through the sac, must leave a *hernia* above it, with a sac still open as before; and the ligature cannot be employed to the part of the sac lying above the ring, without splitting up the tendon of the external oblique muscle, which would take off so much of the natural support of the parts, as almost certainly to allow of a future descent. *Thirdly*, the danger of the operation is a principal objection. A ligature applied around a part of the *peritoneum* must inflame it; and as this membrane is continued without interruption along the sac into the cavity of the *abdomen*, the inflammation will follow the same course, and expose the patient's life to hazard." (p. 62.) In support of this latter objection, Cooper refers to Petit's (*b*) experience. "I opened the tumour," says the latter, "and replaced the *omentum*; I then detached the sac, and tied it as I had seen done, and dressed my patient. In two hours time I was much surprised at receiving a message that he felt great pain over the whole belly, and severe gripings. I hastened to the patient, fancying that the intestine might have slipped into the ring and become strangulated; but when the dressings were taken off, and nothing was found in the wound, I concluded that the mischief had been caused by tying the sac. I cut the ligature and removed it, and dressed the parts simply; the symptoms were immediately relieved, and ceased entirely in an hour. This is not the only observation I have made on the subject; all I have seen has confirmed me in the opinion, that the ligature of the sac, or in other terms, of the *peritoneum*, since the sac is formed by that membrane, may bring on symptoms very like those caused by strangulation of the intestine. I cannot doubt that those whom I have seen perish after the employment of the *punctum aureum*, have died from inflammation of the belly, caused by tying the sac." (p. 339.)

Lawrence also comes to the same conclusion in regard to the proposed operations for the radical cure of ruptures.—"I cannot believe," says he, "that any one of the methods now under consideration is calculated to attain the proposed object. Why does the rupture return after the operation? Because the ring has been enlarged by the previous protrusion, and is still further weakened by the incision necessary for removing the stricture. This state of the tendinous openings would not be altered by closing the

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(*a*) Compare Hesselbach, p. 245; Jacobson, p. 77; Sigmund; in Hufeland's Journal, March, 1841.

(*b*) Traité des Maladies Chirurgicales, vol. ii.

mouth of the sac, even if we could accomplish that object. We must reject the ligature on account of the danger inseparable from its employment, and we have no sufficient reason for placing confidence in scarification of the sac or in its removal by dissection. In many instances these latter methods would be neither easy nor free from danger. Hence we account for the circumstance that all these various methods have become completely obsolete." (p. 321.)]

1161. The *treatment* of *strangulated rupture* must be directed according to the different character and severity of the symptoms; in reference to which, suitable remedies must be employed with due circumspection and choice; too violent attempts, and especially too frequent changes, and again, new experiments which have in so great number been proposed and boasted of, are to be avoided. But too frequent is the course of strangulation hastened by improper treatment, and the patient's condition rendered worse. The more acute the inflammation, the more dangerous is it.

1162. Inflammatory strangulation requires blood-letting, especially if the symptoms be severe, if the patient be strong, the rupture and the belly very painful. Small pulse, cold limbs, pale countenance, must not prevent blood-letting, as these are the peculiar symptoms of violent inflammation of the belly. The earlier bleeding is performed, and the more blood is taken at once, even till fainting is produced, the better is its effect. Leeches may also be applied about the region of the rupture, and because they usually here produce an erysipelatous inflammation of the skin, they may be applied about the *rectum*, (Birago,) (*a*) and cold fomentations, at the same time upon the hernial sac or cold sprinklings to the rupture. If the rupture be very tense and painful to the touch, it must be attempted by these means first to produce a favourable change, general and local relaxation, before the *taxis* is employed, which must be done in the most dexterous manner, according to the above-described rules. If the rupture be less painful, we may commence the treatment with the *taxis*, and if this be not successful, the above treatment must precede subsequent attempts with the *taxis*. All internal remedies, especially purging, are in this strangulation hurtful; even calomel, which has been recommended by many, (Rust, Seiler, and others,) I have always noticed as having only an injurious effect. The patient must merely take mild drinks, for example, almond milk, gum water, and the like, in small quantities. Clysters in severe inflammation, merely soothing, with the addition of castor oil, and in diminished inflammation, of infusion of tobacco or tobacco juice, are extremely efficient.

Tobacco clysters are not to be considered as irritants, but as narcotics, and the employment of *belladonna* or *hyoscyamus* are similarly circumstanced, only the operation of the tobacco is less dangerous; from it ensue a disposition to *nausea*, to fall down, faintness, slow pulse, and diminution of the tension of the rupture. The effect of the tobacco juice and infusion is similar, but the tobacco-juice clysters are very troublesome, the necessary preparations for which are not always at hand. For the infusion, from half a drachm to a drachm of tobacco is used in from twelve to sixteen ounces of water, for two clysters. When injurious effects have been observed, the quantity of tobacco was too large.

[Tobacco clysters are very uncertain, and have been occasionally very dangerous remedies; as the strength of the infusion varies considerably according to the freshness and goodness of the tobacco leaves, of which it is scarcely possible to judge. The use of tobacco clysters, which was formerly much urged by Astley Cooper in cases of strangulated rupture, is now much less practised than formerly; indeed I have not known it used at St. Thomas's either by my colleagues or myself for many years.

(*a*) Compendio di Osservazioni cliniche sul vantaggio delle Mignate applicate all' Ano nelle ernie inguinale et addominali incarcerate, e sulla potassa caustica applicata in diverse malattie di carattere linfatico. Milano, 1821. 8vo.

We prefer, in the event of the failure of the *taxis*, after warm bath and quick full, bleeding, at once to resort to the operation, considering it the most safe practice.—J. F. S.]

1163. If the symptoms be less severe, and if complicated with spasm, warm bathing, rubbing in volatile ointments, with opium or oil of henbane upon the belly, tobacco clysters, cold applications upon the rupture, and in powerful persons, a large bleeding in a very hot bath, are most efficient remedies, after which sudden relaxation follows, and the reduction is effected. Here also internal remedies are ordinarily hurtful, as they increase or excite vomiting, as purgatives, with whatever addition, ipecacuanha in repeated doses, and so on. A simple emulsion with *aqua lauro-cerasi* is, among these, the most proper. The *taxis* must here also be at first attempted, and if it do not succeed, must be repeated after the remedies mentioned.

1164. In *Chronic Strangulation*, when, from collection of stools, but without any inflammatory symptoms or vomiting, or when these, though rarely, are present, stimulating clysters of vinegar and water, soap and water, solution of salts with castor oil, solution of tartar emetic, infusion of senna, tobacco clysters, cold applications upon the rupture, and internally purgatives, in very chronic cases calomel alone, or with opium and colocynth extract, (A. COOPER,) even with jalap or croton oil, (VON WALTHER,) have been directed. But when vomiting has set in, the latter remedies always render the patient's condition worse. With the *taxis* it must always be attempted to compress the rupture, in order to return part of the collected stool. When inflammatory symptoms have come on, the above-mentioned treatment must be employed in correspondence with circumstances.

1165. The *taxis* must be employed in strangulated, in the same way as in reducible rupture. The patient, after having emptied his bladder, must lie in such posture that the seat of rupture be raised, and the walls of the belly properly relaxed; in inguinal and femoral ruptures with the rump raised, the chest bent slightly forwards, and the thighs drawn up towards the belly, but not separated from each other. The practitioner stands on the right side of the patient, grasps the hernial swelling with the fingers of his right hand, and places the fingers of the left in the region of the mouth of the sac, and endeavours, by alternately pressing the rupture together, and in the direction of its escape, to press it back into the belly. In small, for instance, femoral and umbilical ruptures, the fingers of both hands may be applied around the swelling to compress and return it. Herewith the rupture must be carefully moved from one side to the other, kneaded between the fingers, and the pressure only gradually increased. Violent pressure is to be avoided, because severe pain, increased inflammation, and even rupture of the bowels or of the hernial sac may ensue, and the *taxis* must not be too long continued; but it must also be remembered, that without pain scarcely one strangulated rupture can be reduced. These manipulations may be continued for from a quarter to half an hour, and in chronic strangulation, even longer, and with greater force. We should endeavour to withdraw the patient's attention to some object, and forbid all effort and straining. If the *taxis* be unsuccessful, the patient must be left quiet in the same position, with the thighs supported in the hams; and it must be considered, according to the circumstances, what further remedies are to be employed, and whether the attempts with the *taxis* should be repeated. Nothing is more injurious than excessive violence and rough handling. I have observed not unfrequently, that by keeping quiet, after the most careful attempts at reduction have failed, the rupture returns either of its own accord, or with a slight assistance on the part of the patient.

1166. If the reduction succeed, the symptoms usually soon cease, and relief of the bowels ensues either of themselves or by the use of purgatives and clysters (1). If the inflammatory symptoms continue, they require corresponding treatment. The abdominal ring should always be examined with the finger, in order to ascertain that no part of the rupture remain in it, as may be the case, especially in external inguinal ruptures, in which I have several times observed, after a tolerably bulky, and in one case, even very large rupture, had returned, and the external ring was free, that there was strangulation of a small portion of intestine at the inner ring, which rendered the operation necessary. But if under the treatment prescribed there be no satisfactory change in the rupture, but on the contrary, it become more hard and painful, the belly tense, and the vomiting more frequent, neither the use of other remedies, nor attempts with the *taxis* are to be persisted in, but the operation must be had recourse to.

The treatment proposed for strangulated rupture, in reference to the employment of remedies internally and externally, and of the *taxis* is very various. Although these several modes of treatment may be grounded on many good results, the above-described method must be considered most preferable, if it be employed with discretion and proper circumspection.

The position of the patient under the *taxis*, with his feet or knees upon a person's shoulders; the *vertical* position of the body, in order thereby to effect the return of the intestines through their proper tendons, and the application of ice poultices upon the rupture (RIBES) (*a*), with the *pelvis* raised and the head depressed; the posture upon the opposite side, with the thigh drawn up on the affected side (HEY); even the position on the knees and elbows. Continued pressure on the rupture with a weight or bladder of quicksilver of from two to five pounds; or by the patient's hand. Shaking the whole body by driving in a wheel-barrow (PREISS); injection of air into the *rectum*, and drawing it off with a clyster-pipe. The introduction of a thick elastic tube through the *rectum* into the sigmoid flexure of the colon, after O'BEIERN's manner (*b*), who considers the collection of the intestinal gases and the spasmodic closing of the *rectum* as the most common cause of strangulation. The application of dry cupping-glasses about the hernial swelling, or of a glass bell, out of which the air may be pumped by some strokes of an air-pump, till the rupture is as high again, after which it either returns of itself, or is easily reduced with the *taxis* (*c*). Clysters of *hyoscyamus* and *belladonna;* a mass of *belladonna* ointment smeared over the interior of the *rectum;* or a bougie smeared with extract of opium and of *hyoscyamus*, of each two grains, passed into the *urethra* (RIBIERI, GUÉRIN). Purgatives of all kinds; rubbing of croton oil on the belly; galvanism (*d*); clysters of lead wash (NEMBER, RENNERTH, PREISS); tartar emetic (CHURCH); muriate of morphia (BELL.)

[(1) It is perfectly true, that in general after reduction the symptoms of strangulation subside; but now and then they do not, which may depend upon the damaged condition of the bowel, or simply on the existence of *peritonitis*. Instances of the latter are not very uncommon, and can scarcely be distinguished from the symptoms of strangulation, except by the absence of the hernial swelling. Of the former I had an example under my care in 1840, which was a source of great anxiety, and terminated fatally.

Case.—J. S., aged seventeen years, ruptured himself on the right side whilst lifting hampers into a cart in the afternoon of

Nov. 30, and immediately observed in the *scrotum* a swelling as large and as long as his thumb. Half an hour after he began to vomit, and continued to do so through the night. On the following morning the *taxis* was unsuccessfully employed, and afterwards

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(*a*) Gazette Médicale, July, 1833.

(*b*) Dublin Jour. of Medical Science, Sept. 1838.

(*c*) HUAF, De usu Antliæ pneumaticæ in arte medicâ. Gardæ, 1818.—KÖHLER; in HECKER's lit. Annalen, 1835, April.

(*d*) Archives Générales de Médecine. 1826.

a few leeches; some medicine was given, which was rejected; he continued vomiting during the day, had not any relief from the bowels, and suffered pain in his belly. Next morning the rupture was reduced and a truss applied, but removed two hours after, as it was too large. During the day he was relieved of the pain, but vomiting occurred five or six times, and especially on attempting to take anything into his stomach. Towards 8 P.M. the swelling reappeared, about half the former size; the vomiting became more frequent, and the pain in his belly increased.

Dec. 3, 2 A.M.—He was bled nearly to fainting, and the rupture returned; a cold mixture in a bladder was applied (for what reason did not appear) to the region of the swelling, and replaced continually as it became warm. The vomiting, constipation, and pain continuing, he was brought to the hospital at

½ *past* 3 P.M.—He was immediately put in the warm bath, where I examined him, but even when standing up could only observe a slight fulness in the right groin, probably from the leeches, and very deeply a small indistinct swelling not exceeding the size of a small bean, between the abdominal rings; it neither dilated on coughing, nor yielded to pressure. I could pass my finger readily into the external ring. His belly was full and tympanitic, and he complained of pain and tenderness specially about the hypogastric region. The pulse was small and quick; but he had not any anxiety of countenance. I could not feel satisfied of the existence of a rupture, and therefore ordered five grains of calomel and an injection of infusion of senna and salts, which was retained; but an injection of castor oil in the course of the evening returned immediately.

11 P.M. I made another careful examination, in consultation with my friend CALLAWAY, and I thought I felt a slight gurgling, but very doubtful; it could not be felt again, and we both were satisfied that the swelling was merely the spermatic cord. We therefore ordered a grain of calomel, and half a grain of opium, every hour, with a castor-oil injection immediately: and thirty leeches to the belly, with subsequent fomentations, considering his attack to be peritoneal and enteritic.

Dec. 4. The bowels continued obstinately costive throughout the whole day, except a very small quantity of thin watery stool once in the afternoon, and again in the evening, although injections were thrice thrown up. The vomiting did not recur, but he felt nauseated, and the tenderness and tympany of the belly increased. When I saw him at nine in the evening, his tongue was much loaded, and the gums reddened, but without soreness or mercurial smell. The little enlargement in the inguinal canal still remaining, I fancied I again felt a slight gurgle, but it ceased almost immediately. The calomel and opium were ordered every three hours; half a drop of croton oil directly, and to be repeated two hours hence, if requisite; thirty leeches to the belly, and fomentation. I had scarcely left him when he vomited about a pint of dark-green and very fetid fluid. The croton oil was taken at ½ *past* 10 P.M., and after an hour producing only a small thin motion, the second dose was given. Two hours after, his bowels acted again, and he again began to vomit, and vomited and passed thin, but more fæculent motions five or six times before

Dec. 5, 7 A.M. when he became quiet, and two hours after took some bread and milk, which he retained till

11 A.M., and then rejected; his countenance is now much shrunk and flushed, but he is cheerful, and wishes something to eat: pulse 100, and small. He has much pain in the belly, but it is less distended. An hour after he had another loose motion.

2 P.M. In consultation with my friends GREEN and CALLAWAY, we were satisfied that no intestine was down, and the slight fulness already mentioned had entirely disappeared. The calomel and opium which had been withheld at the last period, was ordered to be resumed, and a mustard poultice applied over the belly. Soon after the application of the poultice, vomiting of thin, yellow, acid-smelling fluid recurred, and continued frequently till evening, when I ordered him effervescing mixture, with large excess of alkali, but without benefit, and the vomiting continued through the whole night and following day, not being at all checked by two minim doses of hydrocyanic acid, with compound spirits of ammonia, every six hours. As his mouth was untouched by the calomel, I ordered on the morning of this day,

Dec. 6, that he should rub in a dram of mercurial ointment, with five grains of camphor, every four hours; a large blister over the whole belly, and a colocynth injection.

8 P.M. No motion since noon yesterday; the vomiting continues, and he is much sunk. To take a grain of solid opium every six hours, and have some brandy and arrow-root.

Dec. 7, 4 P.M. He died, having continued to vomit since the last report, and not having had any relief from the bowels.

Examination.—After raising the tendon of the external oblique muscle from the inguinal canal, the edge of the internal oblique was seen uplifted by a small dark-coloured tumour about the size of a hazel nut, which was evidently a hernial sac and contained dark-coloured fluid. The internal oblique and the transverse muscles were then carefully divided up to the internal ring, to which the sac was easily traced, and the latter having been carefully opened about its middle, about a drachm of *serum* escaped. The sac was cut up to the internal ring, through which a very small knuckle of dark-coloured but shining intestine protruded. The belly was next opened; it contained no fluid, and little apppearance of inflammation, except a thin film of adhesive matter slightly gluing together the intestines in the right iliac pit. The abdominal muscles having been completely turned down, about eight inches of very dark-coloured yellowish green intestines were exposed, distended immediately above the portion of gut in the mouth of the sac, with thin fæculent matter like his last stool; an inch of the bowel below the sac's mouth was of the same dark colour, and suddenly terminated by a distinct mark of strangulation, upon which, beneath the *peritoneum*, fibrin had been poured out. Below this point the gut was healthy but contracted. The portion of intestine in the sac was about two-thirds of its tube, the part nearest the mesentery, being quite above the internal ring. In examining further, this protruded piece of gut dropped out, and there was not found upon *it* the slightest mark or appearance of strangulation.

From this examination, I presume, that the strangulated bowel had been returned by the medical man who last saw him; that the strangulation had been sufficiently long to destroy the vitality of the intestine, which had therefore never recovered itself; that the portion of intestine found in the mouth of the sac, had been forced in by the vomiting but that *it* had never been strangulated nor incarcerated, nor had probably been there constantly, through the course of the disease, though it might have been occasionally, by the effort of vomiting; and that the costiveness depended not on the tube of the bowel being impervious, but on its death having destroyed its functions, and that the stools passed were merely forced by their quantity through the dead intestine.—J. F. S.]

1167. The decision as to the proper time for the operation, especially depends on the kind of strangulation, on its severity and duration, on the constitution of the patient, and on the effects which the previous remedies had produced (1). In inflammatory strangulation, in small ruptures, which arise suddenly from external violence, or in those where the strangulation is at the mouth of the sac, (*par.* 1135,) in young vigorous persons, the operation must not be delayed; if by the preceding treatment reduction have not been effected, or if the painfulness of the rupture will permit no further attempt at reduction. It is often necessary within the first eight or twelve hours. In such cases can the advice of KERN and WATTMANN be alone applicable, not uselessly to waste time by attempting relief with external and internal remedies, but immediately to employ the only helpful remedy; to wit, cutting into the rupture. In spasmodic and chronic strangulation, the operation may be delayed; very frequently repeated attempts at reduction should, however, be avoided, and after the most powerful remedies have been employed, it is better to resort earlier to the operation, than by further delaying it to put the patient's life in greater danger. But the operation is in these cases specially indicated, if an inflammatory condition be superadded, especially in old persons. In general, the longer the operation is delayed, the more unsatisfactory is the *prognosis*, as the danger is less from the operation itself, if properly conducted, than from the degree of inflammation and the circumstances thereon depending.

[(1) The invariable rule in all cases of rupture in which symptoms of strangulation exist, be they slight or severe, if the *taxis*, after warm bath and bleeding have been unsuccessful, is without loss of time to proceed to the operation, as the most safe for the patient. For the damaged state of the intestine is frequently not indicated by corresponding severity of symptoms, as is well known to every one who has often operated in strangulated rupture. Every hour, therefore, which defers the operation adds to the patient's danger; on which account we cannot operate too early, when satisfied that strangulation cannot be relieved without.

Occasionally it happens that patients will not submit to an operation for strangulated rupture, and nothing then remains but to persist in the employment of one or other of those remedies which have been proposed. The tobacco clyster is now therefore permissible, and should be resorted to, and the continued application of ice poultice (ice roughly pounded or a freezing mixture, consisting of hydrochlorate of ammonia and nitrate of potash, five ounces of each with a pint of water,) in a bladder upon the swelling, which sometimes succeeds; but the condition of the skin should be attended to during its use, as it may become frost-bitten, and though the rupture may be reduced, the skin may slough, which happened to a patient of the elder CLINE. Sometimes the patient having withheld his consent for many hours, being at last worn out by the vomiting, will submit to an operation; the question then comes, should it be performed under unfavourable circumstances? I think it should; for, without an operation, he must certainly die, and with it he has a chance, however slight, of recovery. Indeed I think the operation for strangulated rupture should always be performed, if the patient be not *in articulo mortis.*—J. F. S.]

On Strangulated Rupture in particular, the following writers may be consulted:—

ZIMMERMANN, Beobactungen der beruhmtesten Wundärzte neuerer Zeit zur Erlaüterung der sichersten Behandlungsarten eingeklemmter Brüche. Leipzig, 1832. fol.

STEPHENS, Treatise on Obstructed and Inflamed Hernia. London, 1829.

RUST, Ueber die rationelle Behandlung eingeklemmter Brüche; in his Magazin, vol. xxix. pt. ii.

SINOGOVITZ, Anleitung zu einer zweckmässigen Manualhülfe bei eingeklemmten Leisten und Schenkelbrüchen. Danzig, 1830.

1168. The operation for strangulated rupture proceeds by the following steps:—*first*, The incision of the skin; *second*, The exposure and opening of the sac; *third*, The dilatation of the neck of the sac or of the abdominal ring; *fourth*, The return of the intestine.

Previously to the operation, the urinary bladder should be emptied, the seat of the rupture, if hairy, shaved, and the patient so placed on a narrow table, covered with a mattress, that the rump and chest be raised, and the belly properly relaxed; or so upon the edge of a table, that the feet may rest on and be supported by a stool.

1169. The skin above the hernial swelling is to be raised into a transverse fold, the one end of which is given to an assistant, and cut through with a bistoury (1). By means of a grooved director introduced into the angle of the wound, the incision is to be enlarged upwards and downwards, so that it extend beyond the swelling in both directions (2), if the tension of the skin do not permit the formation of a fold, the incision must be made freely, the skin being drawn aside by the thumb and forefinger of the left hand. As there are ruptures without sacs, or as the sac may be torn, the incision through the skin must be cautiously made, and the director used as much as possible.

[(1) Lifting up a fold of skin over the rupture, and either cutting through it, as here recommended, or piercing it with a bistoury, and cutting out, is, I think, bad and dangerous practice; for it cannot always be ascertained what the thickness of the coverings of the sac are, or indeed whether there be any other than the skin, and therefore, in not very dextrous hands the sac may be opened at once, and the gut injured. This mode of commencing the operation may seem smart and flashy, but it is dangerous and improper, and entirely devoid of any good reason for its performance.

(2) In inguinal, or rather in scrotal rupture, it is better that the cut made lengthways, should not extend below the bottom of the tumour; it should terminate an inch above it, as room in the operation is not wanted there. The cut should extend above the swelling, otherwise the stricture is so inconveniently deep, that it will commonly be necessary to

enlarge the external wound after the sac has been opened, and before the division of the stricture can be made.

In femoral, umbilical, and other ruptures, it is not needful to extend the cut beyond the swelling, because the flaps usually made either by the ⊥ or crucial cut, afford ample space for the continuance of the operation.—J. F. S.]

1170. The exposure of the sac requires care, as the coverings are very different, and in old ruptures considerably degenerated. At the part where protected from any other injury, or where fluctuation is most distinct from the fluid contained in the sac, the coverings must be taken hold of with a pair of forceps, raised up in a heap, and divided with the bistoury held flat (1) ; this is to be repeated till the sac is laid bare, which is known by its shining surface (2). The blood flowing from these cuts must be carefully absorbed with a sponge. The hernial sac itself should be raised in a similar manner, and cut into, from this opening a little fluid usually escapes ; for though the *omentum* be fallen over the surface of the intestine, the shinyness and smoothness of the sac show the practitioner that he has penetrated its cavity (3). The edge of this opening is to be raised with the forceps, and enlarged with blunt-ended scissors, till a finger can be introduced into it, upon which the scissors (4), or button-ended bistoury, should be introduced, and the opening of the sac increased upwards and outwards throughout its whole length (5). If on opening the hernial sac, an adherent part be lighted on, the opening must be enlarged at some other part, till the finger can be introduced, to destroy the adhesion, if it be gelatinous, or if membranous, to divide it with the knife. In firmer fleshy adhesions, we must proceed as will be hereafter mentioned (6).

If after these appearances, it be doubted whether the sac be opened or not, the swelling is to be pinched up with the thumb and forefinger into a fold, and that held between them gradually allowed to escape, when it is distinctly felt whether there be merely intestine or the hernial sac also.

[(1) In dividing the coverings of the sac, I prefer, after the skin has been completely cut through, scratching with the end of the probe or director, till a layer of the cellular tissue be penetrated, and then introducing the director and dividing upon it; after which a second and other layers are to be divided in similar way, even to the opening of the sac itself. This is much safer than nipping up with the forceps and opening with the knife laid horizontally, which, however, cautiously used, may, in opening the sac itself, risk the puncture of the intestine; an accident which once occurred to myself when I was a young operator.

(2) The hernial sac cannot always be distinguished by its shining appearance, for occasionally it is thick and opake, especially after long wearing a truss; and I have again and again seen the sac opened when the Surgeon supposed he was far from having reached it. Also if, as in rare cases, it happen that the sac and its contents be glued together more or less completely, this distinction does not hold.

(3) The most certain proof of the sac being opened, is the escape of the fluid in greater or less quantity contained in it, which is proportioned generally to the length of time the patient has had the rupture, and also of the existence of strangulation. It is a most satisfactory indication of the course of the operation, but the Surgeon must not expect always to have it. During the course of the last few months I had a case of strangulated rupture, in which not a drop of fluid escaped when the sac was opened.

The colour of the fluid escaping, when the sac is cut into, varies considerably; sometimes it is almost colourless, sometimes red as blood, and CALLAWAY told me of an instance in which even a clot of blood was found in the sac; the case, however, did well.

(4) I prefer the director and knife to the scissors, and throw aside even the director immediately the aperture is sufficiently large to admit the finger, which is always the best guide for the knife, and the greatest protection to the contents of the sac.

(5) There is no need, as already mentioned in regard to the external wound, to open the sac down to its bottom ; but it *must* be divided up to the stricture.

(6) Whenever an artery is disposed to bleed, if divided whilst cutting through the several coverings, it is better at once to tie it, as the bleeding often causes confusion.—J. F. S.]

1171. In many cases, when the strangulation is not considerable, or depends on the peculiar position of the intestines, their entanglement, or their circular enclosure by the *omentum*, the protruded parts may be returned when they are properly untwisted; or when the part of the intestine at the seat of strangulation has been a little drawn out, and by a gentle pressure, it has been attempted to return the contents of the bowel into the belly. If the intestine be strangulated in a fold of the *omentum*, this must be freed with the bistoury, if the intestine cannot easily be drawn out of it.

[In the College Museum is a very remarkable instance of strangulation of a small intestine, by a smooth round cord, two and a half inches long, and about a line thick, extending from the end of a *diverticulum* on the *ileum* to the mesentery, about an inch and a half from the edge of the intestine. In St. Bartholomew's Museum there is a similar case of a *diverticulum* from the small intestine to the mesentery, forming a circular hole, in which the gut is strangulated. The patient was subject of obstinate costiveness, and died in four days. In St. Thomas's Museum there is an instance of strangulation of small intestine by a band from the ascending *colon* to the mesentery. And at St. Bartholomew's a preparation of the small intestines of a child of seven years old, strangulated by a narrow thread-like band from the mesentery; he was admitted for constipation, and died fourteen days after.—J. F. S.]

1172. If reduction cannot be thus effected, the seat of strangulation must be dilated, which may be done either by *cutting* or by *stretching*.

1173. *Dilatation by cutting* is effected in the following way:—The intestine is to be withdrawn in the most careful manner by an assistant, from the place where the cut is to be made; the sac should be drawn somewhat outwards with the thumb and forefinger of the right hand, and the tip of the left forefinger is to be introduced between the intestine and the neck of the sac; a straight or curved narrow bistoury, with a blunt end, should be introduced flat upon this finger, its cutting edge directed towards the place where the cut is to be made, and the seat of strangulation cut into by raising the handle of the knife, or by pressing its edge up with the finger of the left hand; but if the strangulation be so great that the finger cannot be introduced, after drawing down the neck of the sac, a director, curved according to circumstances, and oiled, is to be introduced between the intestine and the seat of strangulation, its groove turned towards the part where the incision is to be made, its handle so held with the fingers of the left hand, that they separate the intestines from the director, and give it such position, that its point rests against the inner surface of the *peritoneum*; and then upon its groove the button-ended bistoury should be introduced. If the seat of strangulation be deep, it is more safe to draw the intestines a little down, so as to be able to see the seat itself. The direction of the cut should always be such as to prevent serious injury; and its size such that the forefinger may, without violence, be introduced at the part where the stricture was situated. It is then to be ascertained by the introduction of the finger into the belly, whether any second strangulation exist which requires a second dilatation.

There are peculiar instruments for dividing the strangulating part. PETIT's straight and curved fork director; MERY's and MOHRENHEIM's winged director; the *straight* bistoury, with a button or probe end of PETIT, BELLOCQ, BRAMBILLA, DZONDI; the *convex* one of LE BLANC, BRAMBILLA, DUPUYTREN, SEILER; the *concave* of PERRET, HEISTER, ARNAUD, RICHTER, RUDTORFFER, ASTLEY COOPER, LANGENBECK, and others, merely a modification of POTT's bistoury, the *concealed* bistoury of BIENASE, LE BLANC, and LE CAT.

[In the division of the stricture, the use of the finger, as a guide for the introduction of the blunt-ended bistoury, is far preferable to the director; and being sure that it is by far the safest, I rarely use any other, however tight the stricture may be. If the finger can fairly reach the stricture, and the smallest part of its tip can be introduced, a very little gentle thrusting will make room for the entrance of the point of the knife. In inguinal rupture I do not recollect to have used a director more than two or three times, and but little more frequently in femoral. The director is a very unsafe instrument, where out of sight, for however carefully the intestine may be tended, it will occasionally turn over the director, and be cut in dividing the stricture, which I have seen happen once or twice. When it is absolutely necessary to use the director, in consequence of the impossibility of getting the tip of the finger into the stricture, I have protected the intestine by introducing a spatula between it and the director up to the very stricture. But when this difficulty occurs, it is advisable to lengthen the cut upwards through the skin and coverings of the sac, till the stricture is brought completely and distinctly into view, and then to introduce the director.—J. F. S.]

1174. The *bloodless dilatation*, or that *without cutting*, which is only applicable in those cases where serious injuries, not well to be avoided, forbid incision, may be effected either by the introduction of the finger, or with a proper dilating instrument, (Le Blanc's dilator,) or with a small hook, (Le Cat's S-shaped hook, and Arnaud's hook;) which is to be carefully introduced between the intestine and the seat of stricture, and therewith extension made, sufficient to render the reduction possible. Bruising of the intestine is scarcely to be avoided.

The bloodless dilatation, first proposed by Thevenin (*a*), was particularly recommended by Le Blanc (*b*); but although Le Cat, Arnaud, Richter, even Scarpa, and others have conditionally declared for it, in recent times it has been almost entirely rejected, and only applied, by some, (Trustedt, Rust, Seiler,) to femoral rupture, especially, and in a manner to be hereafter described.

[I know no circumstances in which dilatation without the knife is permissible. I should consider any forcible expansion of the stricture, by pulling or dragging with instruments, dangerous and unwarrantable, as it would be ineffectual for the required purpose without more mischief than would result from using the knife.—J. F. S.]

1175. When the obstruction to the return of the intestines on the part of the neck of the sac, or of the abdominal ring has been removed, it depends on the state of the parts contained in the rupture how their return shall be effected. This is often at once possible, without any difficulty; often must the intestine be carefully unfolded, if filled with stool or air (1). That part of the intestine at the seat of strangulation should always be drawn a little down, to examine its condition. The reduction should be effected with the fingers wetted, those parts first protruded, being carefully first returned; thus the mesentery earlier than the intestine, and that before the *omentum*, according to the direction of the aperture through which they have protruded. The forefinger is then to be passed by this opening into the belly, for the purpose of determining that all the parts are returned (2).

[(1) Always before the intestine is attempted to be returned it should be emptied by gentle pressure of its contents, whether air or stool, which renders the reduction easy; whilst if this be not attended to, considerable difficulty is often experienced. Not unfrequently after dividing the stricture, the tonic power of the muscular coat of the bowel will itself empty its contents; or if they be fluid, they will flow back into the intestine canal, the protruded gut become flaccid and be readily returned into the belly. I do not at all consent to the practice of pricking or cutting into the intestine, if it be indisposed to return, on account of its distension with air. I am sure that after dividing the stricture freely, it is not matter of much consequence whether the gut be returned or not by the operator, as most commonly after a short time the air passes along the freed gut, and the protruded part diminishes in size, and if not restrained by adhesions retracts into the belly.

(*a*) Traité des Opérations. Paris, 1696.

(*b*) Précis d'Opérations. Paris, 1775. vol. ii. chap. vii.

(2) Although there may be little fluid in the sac, yet it is not unfrequent to have it pour forth freely from the cavity of the belly after the protruded parts have been returned. I recollect having a case in which blood-red fluid escaped so largely that I almost feared I had divided some vessel; however, it ceased before the patient was removed from the table. Callaway tells me of an instance in which, after the return of the intestine, a large quantity of honey-like fluid poured forth, he presumes from an ovarian dropsy having been wounded: the patient, however, recovered.—J. F. S.]

1176. The reduction of the intestine may be rendered difficult or impossible—

1. By *adhesions*,
2. By *disorganization*,
3. By *gangrenous destruction*.

1177. If the connexion of the parts with each other depend on a gelatinous substance, it can be easily destroyed with the finger. Filamentous adhesions having been made tense, may be divided with the knife, the edge of which is to be turned towards the hernial sac, rather than towards the intestine. But if there be a fleshy adhesion between the sac and its contents, the practice is different, according as the adhesion is between the *omentum* and the hernial sac, or between the *omentum* and the intestine. In the former case the *omentum* must be divided, as near as possible to the adhesion, with the knife or with the scissors. If the *omentum* adhere to a considerable extent to the sac, it must only be divided at the neck of the sac, surrounded with some linen overspread with cerate, and when the inflammation has subsided, it should be divided near the abdominal ring. (According to Scarpa, it should be tied and tightened daily till it fall off.) The *omentum* often returns into the belly whilst surrounded with the linen (1). In the second case, after the strangulation is relieved, the intestine must be left quiet in its place, covered with compresses moistened in and often wetted with decoction of marsh-mallows (2). It is frequently observed that the piece of intestine gradually returns into the belly. If it remain partially in the abdominal ring, it becomes covered with granulations and adheres to the integument. The same practice must be pursued in the *natural* connexions between the intestine and the hernial sac, when they render reduction impossible.

If the intestine be so considerably distended with stool and air that reduction is rendered difficult, it must be attempted, after *sufficiently* cutting into the constricting parts and after the intestine has been somewhat drawn down, by gentle kneading, and pressing together, to return partially the contents of the bowel, and to diminish the size of the intestine. In such cases the overfilled intestine has been punctured with a large needle. (Lowe,) with a lancet, (Loëffler,) and with the trocar (Richerand, Jonas, Von Graëfe); the latter was successful, and at the same time a loop of the mesentery (*a*) was applied (3).

[(1) If the adhesions between the *omentum* and sac be old and membranous, and easily divided, it is advisable to do so, and to return the *omentum*. But more frequently the adhesions are too short to admit of this; or the surface of the *omentum* is actually glued to, and so consolidated with, the surface of the sac, that it cannot be set free without cutting through. I have had two cases of this kind, in which, having returned the gut, after freely dividing the stricture, I have left the adhering *omentum* undisturbed, and no ill consequences have ensued. But there is a preparation in St. Thomas's Museum, where this practice was pursued, and the gut, after division of the stricture, returned into the belly, yet the symptoms of strangulation continued, and the patient died; and, on examination, it was found that the *omentum* formed a tight cord upon the intestine as it lay transversely behind it, on the brim of the *pelvis*, and completely prevented the passage of the contents of the bowel through it. I do not, therefore, feel certain as to which is the best practice in such cases; but I may state, that

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(*a*) Journal von Graëfe und Walther, vol. iii. p. 255.

my cases which were successful happened after the fatal case just mentioned. I certainly should not be disposed to adopt or recommend the practice proposed by CHELIUS, of separating the adhesions at the neck of the sac, and passing a piece of linen round the *omentum*, with the purpose of dividing it at a future time, as I should expect that the presence of such extraneous substance would be likely to excite dangerous inflammation.

(2) As to the adhesions between the *omentum* and gut, if they cannot be easily separated with the finger, they are best left alone, without attempting further separation or their return, to take their chance together, either to remain in the sac, or return of their own accord into the belly.

(3) There is in the Museum of the Royal College of Surgeons of England, a preparation of a portion of strangulated small intestine, which not being returnable on account of the great quantity of air it contained, was cut into, to the extent of an inch, and left in the sac, and the patient died. I cannot imagine there is any necessity for puncturing the intestine to compel its return into the belly, provided the stricture be freely divided; for I know by experience, that if strangulation be relieved, it is of little consequence how much intestine be down. In reference to this point, I recollect the largest scrotal rupture on which I have operated, and in which, before the division of the stricture, there was at least half a yard of bowel down, filled with air; and, after the stricture had been cut through, at least as much more thrust through, so that I almost despaired of getting any back; yet after a time I returned the whole. To my vexation, however, next morning I found my patient had got out of bed to relieve himself on the chamber-pot, and as might be expected, the bowel had descended, and in such quantity, that the *scrotum* was at least as big as a quart pot, and the vermicular motion of the intestine was distinctly seen through the stretched skin. Nothing further was done than to keep the tumour raised above the level of the abdominal ring, by placing a pillow beneath it, and by degrees it returned, and the patient never had an untoward symptom.

If, however, the bowel be filled with solid matter, as hard stool, or apple or potato skin, and its return thus prevented, as well as the passage through it stopped up, an instance of which latter kind is in the College Museum, then the loaded gut ought to be cut into freely without hesitation, as the only means of perhaps saving the patient's life. But such cases I suspect are exceedingly rare.—J. F. S.]

1178. If the *omentum* be converted into a tangled lump, it must not be returned into the belly, because it requires a too large dilatation of the abdominal ring, and this degenerated mass may produce inflammation and even suppuration in the cavity of the belly. The general advice in these cases, is to tie the *omentum* above the degenerated part, to cut it off below the ligature, to return the tied part into the belly, and to fasten the threads externally. The ligature of the *omentum*, however, causes a new strangulation (1).

Experiments on animals, and numerous practices upon man, show that the *omentum*, cut off and without tying, may be returned into the belly without injury (2). But if the vessels of the cut edge of the *omentum* bleed they must be tied singly and the threads allowed to hang out externally, or torsion must be performed on them (3). The recommendation of allowing such diseased pieces of *omentum* to lie out, (POUTEAU, DESAULT, VOLPI, ZANG, and others,) proves the objection, that by fastening the *omentum* in this position, severe disturbance of the stomach and so on may be produced. If the *omentum* be sloughy, the sloughy part must be removed with scissors, and treated in the way prescribed. In these cases, generally the *omentum* becomes adherent to the neck of the sac, which it then closes like a plug.

[(1) I have tied the *omentum*, and cut off the part below the ligature several times, without any of the untoward results commonly, and as by CHELIUS, assigned to this practice.

(2) The largest portion of *omentum* I have known removed was seven ounces and a half, in a case of scrotal rupture, in a man forty-two years of age, under CALLAWAY's care; he recovered, and the preparation is in the Museum of Guy's Hospital.

Key (*a*) advises, that "the *omentum* should be unfolded before it is divided by the knife; otherwise the cutting off the *omentum* in a mass prevents all the vessels being seen, and when returned into the *abdomen* they bleed profusely." A case of this kind happened to him, in which he cut off "a large portion of *omentum* with one stroke of the knife, securing the bleeding arteries before returning it to the mouth of the sac. In four hours after the operation blood of an arterial colour began to ooze from the sac, and soon increased in quantity to alarm the dresser. He used pressure and cold to no purpose. Her pulse began to falter, and her face was bedewed with a cold perspiration; and in this state I found her, when early on the following morning I was called to see her. It was evident she had lost a very large quantity of blood, and had she not been possessed of an unimpaired constitution, she could not have supported the loss. I opened the sac, removed the *coagulum* with which it was filled, and was proceeding to look for the bleeding vessels of the *omentum*, when I fortunately observed the hæmorrhage had suddenly ceased. The only ill effect of the hæmorrhage was the disturbance of the adhesive process, and the consequent suppuration in the sac, as she ultimately perfectly recovered." (p. 43, *note.*)

When necessary to remove *omentum* I generally tear it off as far as possible, and afterwards cut through the part which will not tear. I have rarely had occasion to apply any ligatures.

Sometimes if the *omentum* be left, it sloughs; I have seen this happen two or three times without any inconvenience. Astley Cooper (*b*) mentions a case in which both *omentum* and intestine were returned into the belly, and after the operation the patient complained of severe pain in the belly; the ligatures on the wound in the *scrotum* were removed; on the following day a small portion of gangrenous *omentum* protruded, more and more gradually descended, till the whole which had been protruded appeared in the wound, sloughed, and the patient recovered. (p. 44.)

Hewett has recently (*c*) given a good account of some cases in which the *omentum* had formed a complete bag around the intestine in strangulated rupture. Although Richter has been stated to have had cases of this kind, yet it appears that he merely notices their existence without mentioning any particular instance, and Hey's cases cannot be admitted as belonging to this class. Hewett states that "these sacs have been found in the three most common forms of *hernia*; but it is in the umbilical *hernia* they have been generally observed; the relative situation of the intestine and the *omentum* in the abdominal cavity will easily explain the fact. Complete omental sacs were found in four cases out of thirty-four operations for strangulated *hernia*, performed at St. George's Hospital in 1842-43; of these four cases two were femoral, one inguinal, and one umbilical. The formation of these sacs is attributed by Richter to the firm agglutination of the margins of the *omentum* which has surrounded the bowel. In this explanation of Richter's, which does not appear to be applicable to the majority of cases, the two following explanations of the manner in which these sacs are in some cases formed have been added:—*First*, the gut, *completely enveloped* by the *omentum*, passes through the ring, and the *omentum* thus disposed round the intestine becomes attached to the circumference of the neck of the hernial sac; this omental pouch is subsequently distended by the intestine, and thus forms a complete lining to the hernial sac. *Second*, an *epiplocele* takes place, and the portion of *omentum* which is protruded becomes altered in structure, and its folds firmly united to each other by the effusion of lymph; but within the abdominal cavity, in the neighbourhood of the ring, the fold, into which the *omentum* has been drawn may not be agglutinated; they will thus leave spaces into which a knuckle of intestine may insinuate itself, pass through the rings and form for itself a bed in the altered mass of *omentum* which is in the hernial sac. It may happen that two or three portions of gut may slip into the different spaces left between the folds of the *omentum*, and subsequently form for themselves separate pouches. Several separate sacs, with narrow necks, may be thus found in the omental mass, which is in the hernial sac. Once formed, these sacs may attain an immense size. In one case the sac measured six inches in length, and eleven inches in circumference at its broadest part. The *omentum* in which a sac has been formed, may in the course of time, especially if it is irreducible, become altered in structure, either by the effusion of lymph or by a deposition of fat, which takes place in the walls of the sac. By this alteration of structure the thickened sac may, in an operation, become the source of very great difficulties. * * * These omental sacs may either lie loose in the cavity of the hernial sac, or the two sacs may have contracted more or less extensive and firm

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(*a*) Cooper's Hernia, above cited.

(*b*) Above cited.

(*c*) Observations on the Omental Sacs which are sometimes found in Strangulated Herniæ completely enveloping the intestine; in Med.-Chir. Trans. vol. xxvii. 1844.

adhesions with each other. (p. 284–87.) The neck of an omental sac may become the *sole* cause of strangulation, of which an instance is given. "The division of the neck of these omental sacs may be followed by hæmorrhage," of which he also mentions a case; the external bleeding at the operation was slight, and soon ceased; but after death a large patch of recently effused blood was found in the folds of the *omentum* near the mouth of the sac. (pp. 291, 92.)]

(3) If the blood have not coagulated in the vessels of the *omentum*, cutting it off and tying them singly is not only an almost interminable business, but also when apparently all the vessels have been secured, and the patient put to bed, after a few hours secondary bleeding occurs from some little vessel or vessels which had escaped notice, the sac and yielding skin become largely distended with blood, in such quantity as to produce faintness, and require the reopening of the wound to remove the blood and tie the bleeding vessels. This disturbance of the wound prevents the adhesive process, and very commonly gives rise to abscess in the sac or its immediate neighbourhood, by which the cure is much retarded. A case of this kind occurred to me, and a large abscess was the result, although the patient ultimately recovered. It is on this account I prefer tearing through the *omentum* as much as possible, by which the ends of the vessels are ensheathed in cellular tissue, and do not bleed, or even tying up the *omentum* together.

The occurrence of abscess in the sac, independent of bleeding, and which sometimes reproduces symptoms of strangulation, has been noticed by Key, as will be presently seen (p. 49); first, in a case which occurred at St. Thomas's Hospital in 1817, which I remember to have noted; and secondly, in a case of his own.—J. F. S.]

1179. If the intestine have a dark, violet, even dusky colour, and its warmth be diminished, these must not prevent its reduction; only, according to some, the precaution should be taken of drawing a loop through the mesentery, for the purpose of keeping the returned intestine in the neighbourhood of the abdominal ring, and to afford a more free escape to the stool, if a part of the returned intestine be destroyed by gangrene.

[It not unfrequently happens, that though an intestine be a dark-chocolate colour when the sac is first opened, yet immediately after the division of the stricture, the colour, which has depended only on venous congestion, begins to alter, and the gut becomes florid. This is always a very encouraging sign.—J. F. S.]

1180. If the gangrene be more severe, which is characterized by loss of gloss, by an ashy-gray colour, by a softened condition, by the easy peeling off of the outer membrane of the intestine, if the gangrenous portion be but small, it must be opened with a lancet, and the gangrenous part fastened in a corresponding position to the abdominal ring. If a loop of intestine be attacked with gangrene, and the continuity of the intestinal canal destroyed, the gangrenous part must simply be cut off with scissors, as by the previous inflammation, adhesion of the rest of the intestine with the hernial sac has been effected, which prevents all effusion of stool into the belly. If the excrement will not escape of itself, an elastic sound must be introduced. The enlargement of the mouth of the sac with the knife is dangerous, as the division easily overshoots the boundary of the adhesion and may cause effusion into the belly.

Stitching up the intestine after cutting off the gangrenous part, as proposed and performed in various ways, is objectionable, as the stitch not holding the inflamed intestinal membranes, produces extension of the inflammation and gangrene.

1181. If in the protruded bowel any wounding substance be found, it must be removed by the wound; if the intestine be so narrowed and degenerated that it can no longer allow the passage of the stools, that part must be cut off, the wound brought together, by means of Lembert's stitch; or the intestine must be fixed in the abdominal ring, by a twist of the mesentery. In very small wounds only of the intestines, may the little opening be tied up with a silk thread (A. Cooper.)

1182. If in an old and bulky rupture, it be certain that it is not possible to return the contained parts, on account of the great adhesion and degeneration, the hernial sac must merely be laid bare at the abdominal ring, the strangulation relieved, and the rupture left where it was (1).

That mode of operating in which the hernial sac is not to be at all opened, but only the abdominal ring dilated so as to return the hernial sac together with the intestine, is, in general, to be rejected, and the not opening of the sac to be most especially confined to those cases in which it is certain that in a recently produced or extraordinary large rupture, or in a rupture entirely adhering to the neck of the sac, the strangulation is seated in the abdominal ring. In most cases the connexion between the aponeurotic opening and the hernial sac is so firm that the blunt end of a knife cannot be inserted between them, especially if a truss have been already worn (2).

Although FRANCO and PARÉ had cut into the abdominal ring and did not open the hernial sac, except when reduction could not be effected, yet the practice was first generally recommended by PETIT, in large and adherent ruptures; after him, by GARENGEOT and MONRO, in recent and small ruptures, and more recently by A. COOPER; but especially by KEY (*a*) and PREISS (*b*) has it been laid down, to a certain extent, as the proper practice (2). The advantages resulting therefrom, are diminution of the danger, as the hernial sac is not injured; as well as that by keeping the air from the cavity of the belly inflammation, in any injury of an artery effusion of blood into the belly, and also injuring and tearing the intestine in incipient gangrene, are prevented; and when it seems necessary, the opening of the hernial sac can always be made. These benefits are, however, sufficiently outweighed by the disadvantages, that without opening the sac no insight can be obtained of the state and condition of the parts, the tightness at the neck of the sac may be caused by the entanglement of the intestine and by the peculiar position of the *omentum*, and the operation, especially in stout persons, is very difficult, and therefore only to be confined to the above-mentioned cases. With this mode of treatment must be placed GUÉRIN'S (*c*) subcutaneous incision of the abdominal ring, which he would employ in all ruptures with recent strangulation from the ring, where, however, no sloughy destruction of the loop of intestine is to be feared. In strangulation by the hernial sac it is not applicable.

[(1) When a *rupture is large and old*, Surgeons generally follow ASTLEY COOPER'S recommendation, of dividing the stricture without opening the sac and leaving the protruded gut in the sac or not, as may be. For this he assigns the following reasons:—"*first*, in very large old *herniæ*, the cavity of the *abdomen* is so much diminished by the habitual loss of the protruded intestine and *omentum*, that it becomes scarcely able to receive them again; and if a reduction is attempted, the force necessary to effect it endangers the bursting of the intestine; *second*, a large surface of intestine is exposed and handled for so long a time, as to produce, even if it does not give way, the risk of an inflammation which will probably be attended with fatal consequences; *third*, if by great pains the intestine be returned, it is scarcely possible to keep it in the now over distended *abdomen*, so that the slightest cough, or effort of any kind, is sufficient to bring it again down into the sac, and thus induce a high and dangerous inflammation; *lastly*, when great adhesion occurs, so much time is necessarily required in performing the operation, to separate the united surfaces, that fears may be justly entertained of the patient not surviving the operation. * * * Hence, in these cases, I would advise only the division of the abdominal ring; or if the stricture is higher up, of the lower edge of the *transversalis* muscle; but the hernial sac should not be opened, unless the stricture is situated in the sac itself." His mode of performing the operation he thus describes:—"I made an incision three inches in length, immediately over the abdominal ring, exposing it with the knife, as well as the *fascia*, which it sends off. I then made a hole in the *fascia* large enough to introduce a director, which I thrust up behind the abdominal ring, between it and the hernial sac; and passing a curved probe-pointed bistoury upon it I divided the ring. I then introduced my finger, and feeling some resistance from the *transversalis*, I carried the bistoury upon the director up to it, and divided this also." (p. 63.) It is rather odd, in referring to COOPER'S first reason for following this practice, that the case on which the operation just described

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(*a*) Memoir on the advantages and practicability of dividing the stricture in Strangulated Hernia on the outside of the sac. London, 1833.

(*b*) Würdigung des Bruchschnittes ohne Eröffnung des Bruchsackes. Wien, 1837.

(*c*) Gazette Médicale de Paris, 1841. No. 33.

was performed, "had existed from the patient's (aged fifty-four) earliest years," and that it "was of enormous size, reaching half-way to the knees," yet after the division of the stricture, "it went up with a gurgling noise, as soon as his hand was laid upon the tumour." And as regards the danger of exposing and handling for a long time a large surface of intestine, as laid down in his second reason for not opening the sac, the only case he refers to is CARPENTER's, who says:—"It was the largest *hernia* I ever remember to have seen;" and, having opened the sac "a large quantity of intestine, with a small piece of *omentum* protruded;" but after dividing the stricture, the adhesions were so great, that he "judged it advisable not to attempt their separation. And from the size of the *hernia*, it was quite impossible to bring the integuments over the intestine, which was therefore left exposed to the air;" yet nothing untoward ensued; "the intestine soon began to granulate, and gradually shrunk within the wound," and the patient recovered. (p. 64.)

This is the operation on which ASTLEY COOPER lays so great stress, observing:—"I feel convinced that this operation will be gradually introduced into general practice when it has been fairly tried, and found, if performed early, to be free from danger, and attended with no unusual difficulty." (p. 64.)

"If we cannot accomplish our object in this manner," says LAWRENCE, "a small aperture may be made in the sac, near the ring, which will enable the Surgeon to introduce a curved director under the stricture; the knife carried along the groove, divides the tendon with ease. When the parts are thus set free, they should be returned into the belly by pressure on the swelling, if adhesions do not prevent this; at all events, they generally admit of being replaced in part." (p. 285.)

(2) I do not think it can be fairly stated from ASTLEY COOPER's published statements, that he is in the generality of cases favourable to, or that he recommends the practice of dividing the stricture, in strangulated rupture external to the sac, but only lays it down as the *general rule* in large ruptures. It is quite true that in his great work on HERNIA, in the first part of the first edition, when treating of the operation for inguinal rupture, he says:—"An advantage is derived from dilating the stricture without cutting the sac itself, for there is no danger of injuring the intestine, &c." (p. 30); and in the second edition he speaks more at length on the subject thus:—"I have occasionally practised, and for some time recommended in my lectures the following mode of dividing the stricture without including the sac. The tendon of the external oblique having been divided a little above the external ring, the sac is gently drawn down, while the muscles are drawn up by an assistant. In this way the stricture is brought into view, and can be divided without risk, and without including the *peritoneum*." (p. 39); and he then enumerates the advantages from this practice, that there is no danger of wounding the intestine, and that if the epigastric artery is cut, as the *peritoneum* is undivided, the flow of blood would be immediately perceived, and then the vessel might be secured. But in neither edition of his Surgical Lectures, neither that in the Lancet of 1823-24, nor that edited by TYRRELL in 1827, does he allude to the division of the stricture without opening the sac, except in large ruptures. In both these editions of his Lectures he also expressly directs opening the sac and says in the one (*a*), after "feeling for the stricture, * * * you introduce the probe-pointed bistoury on the director or finger, and divide the stricture without cutting too much;" (p. 478.) and in the other (*b*), "having thus exposed the contents of the hernial sac, as far as the seat of stricture, the operator should insinuate the point of his finger or a director under the stricture, between the sac and its contents, at the upper part, carefully keeping the latter from turning over the finger or director. He should then pass the knife for dividing the stricture upon the finger or director, under the stricture, and by a gentle motion divide this stricture, &c." (pp. 44, 5.) I may also add that I have no remembrance of having seen him operate without opening the sac, in the many operations for strangulated rupture which I saw him perform in the Hospital during the first fourteen years of my professional life.

To KEY, however, must be justly ascribed the revival of PETIT's operation, and of its more extensive application (*c*). His views with regard to its employment will be seen in the following observations upon fifteen fatal cases. "The majority of the cases," he says, "appeared to have died from peritoneal inflammation consequent upon the exposure of an inflamed or strangulated portion of bowel. I say exposure of the bowel; for it is, probably, not so much the wound in the peritoneal sac that disposes to inflammation, as placing the bowel under circumstances to which it has hitherto been unaccustomed. The sudden change of temperature to which it is submitted, the exposure to

(*a*) Lancet, 1823, 24. (*b*) TYRRELL's Edition of Lectures, vol. iii.

(*c*) Memoir, above cited.

light, and to a current of air, cannot but have some influence upon the delicate circulation of the part, and be productive of some impression on the nerves of so susceptible a surface as that of a strangulated intestine. And if to these influences be added the handling which the gut usually experiences, the reaction that follows these agents, we must regard as a natural consequence and likely (as experience proves) to amount to excessive inflammation. In tracing the inflammation consequent upon an operation for *hernia*, it is found to spread from that portion of the bowel that has been strangulated over the peritoneal surface of the intestines, and not to have its origin from the incision in the sac, although two wounds are usually inflicted upon it, one for the purpose of exposing its contents, and another, higher up, to divide the stricture. The *peritoneum* about the seat of stricture exhibits fewer signs of acute inflammation than the investment of the bowels." (pp. 11, 12.) After giving an "outline of these cases," Key observes, "it is obvious that the attempt to relieve the stricture without exposing the contents of the sac, could not have been attended with any untoward consequences in any of the cases, with the exception of the two cases of gangrene, Nos. II. and XII.; and in these the symptoms denoting the approach or existence of *sphacelus*, were sufficiently marked to point out to the operator the necessary mode of proceeding. Some of the other cases, in all probability, would have been benefited had the sac been left entire." (p. 26.)

Lawrence does not agree with Key in "ascribing the unfavourable state of bowel which was found in so large a proportion of his thirteen cases, (the other two not having been operated on,) and which, I believe, will be met with in the majority of those who die after the operation, to the operation itself and its attendant circumstances, namely, exposure to air and light, change of temperature and handling. I think it rather owing to the pressure of the stricture, which affects the parts, not like the slight violence of the operation, for a few minutes only, but uninterruptedly for hours, and sometimes days, disturbing the circulation, making an impression on the intestine as if it had been tied with a string, and sometimes causing ulceration either of the internal tunics or of the bowel in its whole thickness. That inflammation excited by this kind of injury may cause death is clearly proved by Mr. Key's cases. * * * When we find the intestines at the time of the operation mortified, as in cases II. and XII., distended and discoloured, so that it could not be replaced, and required to be opened, as in case V., so altered that the operator would not venture to return it, as in cases III. and VII., the mischief is obviously independent of the operation, and its source is rendered unequivocal when we see the tube marked by the stricture, and mortified at the part thus impressed, as in case IX." (pp. 279, 80.)

From a very careful consideration of the circumstances attendant on strangulated rupture, and from observation of the appearance which the bowel too frequently exhibits, and the results which follow, I cannot but agree with Lawrence that the mischief is rather owing to the "pressure of the stricture," than with Key, that it is "consequent upon the exposure of an inflamed or strangulated portion of bowel." But I think it is impossible to doubt that an additional cause is to be found in the unwarrantably violent and repeated squeezing which the rupture suffers during the use of the *taxis;* so that one is only astonished that the gut is so rarely burst, and the patient destroyed in a few hours. And then, as Key has well expressed it, "an operation is often regarded as a forlorn hope, resorted to in the extremity of danger, when the injurious effects of delay and violence combine to preclude a chance of success. The effect of exposing a contused part is seen in a common bruise; if the soft parts are severely contused, the skin remaining entire, the inflammation that follows subsides without injuring the texture of the part. But if a small wound accompanies the injury, the inflammation proves destructive in its effects; sloughing of the cellular membrane, with copious suppuration ensues, and the process of healing is tedious. Between a common contusion and an intestine, or *omentum* bruised by the *taxis*, there is a close analogy; a breach of texture, in the one case, leads to the same effects as exposure in the other. Inflammation is in both the result; and the vitality of the parts being impaired, disorganization in both cases follows as the consequence of inflammatory action. If the contusion be not accompanied by a breach of the surface, no harm is anticipated; and just so if the bruised contents of a *hernia* are returned without a wound of the peritoneal sac, and consequent exposure, inflammation, if it does come on, seldom proves severe, and still more rarely fatal." (pp. 58, 9.)

Admitting that "the condition of the bowel, that above all others renders it an imperative duty to open the sac, is that of gangrene," and stating that "it is a remark made by some Surgeons of experience that the intestine is occasionally found to be in a state of gangrene when no symptom had existed before the operation to raise a suspicion of mortification having taken place," Key observes, "it does not, however, appear, that any pains have been hitherto taken to form a correct *diagnosis* of the circumstances under which gangrene has actually taken place; nor am I prepared to say, that, in all cases, such a certainty of *diagnosis* is attainable; I think, however, that if the attention of the profession were more closely directed to the consideration of the condition preceding gangrene, a near approach might be made, sufficiently accurate to direct the Surgeon's practice in all cases." (pp. 103, 104.) I cannot agree with KEY that "the ordinary characters of a completely sphacelated portion of bowel are distinct enough," for I am quite sure that I have seen them all existing more than once or twice without any gangrene, but simply depending on the unwarrantable violence used in attempting to return the rupture. But I do agree with him, that "it sometimes happens that no such change takes place in the swelling, and then the evidence of gangrene is much more equivocal." It is by no means infrequent to find an intestine mortified, although the time it has been strangulated is short, and not the slightest external sign leads to the presumption of its condition; as, on the contrary, it now and then happens that the exterior of the swelling is tender, inflamed, doughy, and crackling, from the causes I have just mentioned, and yet the intestine within be healthy, and the patient recover the operation. As regards the loss of elasticity in the swelling, I believe it a very uncertain sign; the intestine may be gangrenous, but the sac full of fluid, as is commonly the case under such circumstances, and then the elasticity remains. The only sign which I think can be relied on, though even that is doubtful, is when the gangrenous intestine has burst; then, indeed, although the redness, doughiness, and crackling still remain, the rounding of the swelling subsides, and when a little pressure is made on it a central hollow is produced, and a sense of yielding beneath, very different from the pitting caused by pressure on œdematous cellular tissue.

KEY mentions a case which occurred to him, in which "a fetid smell, similar to that described by Sir A. COOPER, was perceptible in the progress of the operation, before the sac was opened." The patient had a femoral rupture, and "a fetid smell arose from the swelling as soon as the *fascia propria* was opened; it was a smell arising from a decomposed portion of bowel, and the transudation of its fæcal contents. The intestine proved to be quite gangrenous, being black, devoid of lustre, and lacerable. Such a *fœtor* might, I apprehend, be discovered in most cases of *sphacelus* before the sac is opened; its absence should be ascertained in every case in which the contents of a *hernia* are to be returned without opening the sac. Before disorganization of the coats of the intestine takes place, transudation of fluid or of fetid air is probably prevented. In incipient gangrene, therefore, it is not to be expected." (p. 109).

One instance of fetid smell before opening the sac occurred to me in the case of strangulated umbilical rupture, (No. X. in my Table,) which had been so for thirty hours; but on exposing the gut at the operation, part of it was quite natural, and part dark chocolate-coloured, but shiny, and did not seem to be mortified; after death, at forty-eight hours from the operation, it had a dirty clay-coloured appearance, very different from that when first exposed.

Admitting that the presence of the fetid smell is always indicative of gangrene, though it has been rarely observed, yet its absence is no certain sign of the healthy state of the intestine; and, therefore, some still more definite symptoms of this dangerous condition of the gut are requisite before it can be decided with certainty previous to opening the sac.

LAWRENCE adheres to the old practice of opening the sac and dividing the stricture from within; he says:—"The mode of proceeding thus recommended by Sir ASTLEY COOPER, and executed by him with perfect facility," which is also fully confirmed by KEY's practice and experience, "would be found difficult to those less intimately conversant with the anatomy of ruptures, and in some cases, probably impracticable. It is therefore fortunate that we cannot regard it as a matter of much consequence. When the hernial sac has been freely laid open, we cannot suppose that the additional division of its neck will much increase the chance of *peritonitis*. If the stricture be divided in a proper direction, the epigastric artery is not endangered. Nor can the intestine be wounded if due care is taken to protect it, by using a deeply-grooved director, or by carrying the curved knife along the finger. It may also be carefully held out of the way when the stricture is divided, either by the operator or assistant; or it may be covered at that time by the handle of a scalpel. Let me observe further, that the method of dividing the stricture on the outside of the sac does not necessarily secure the protruded parts from injury. In an attempt of this kind recorded by PELLETAN(*a*), the intestine was wounded. The question of eligibility between the ordinary course of proceeding, and this modification must be determined, like all other practical matters, by experience. Unless unequivocal advantage should be found in the latter, I should

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(*a*) Clinique Chirurgicale, vol. iii. p. 102.

not recommend its adoption, being unwilling to introduce without absolute necessity, a new difficulty into an operation, always requiring consideration and caution, and frequently attended with embarrassing circumstances." (p. 290.)

From my own personal experience of the division of the stricture external to the sac, I can say nothing, never having performed it. But I do not think so great advantage is gained by not opening the sac, as is stated. From all the cases I have observed, either in the practice of others or in my own, I do not think cutting through the hernial sac, and consequently opening the peritoneal cavity, so serious as generally considered. If inflammation of the *peritoneum* have not been previously set up, either by the rough usage of the rupture, or by the irritation which a long strangulated or gangrenous gut produces, I cannot understand why making a small opening into the peritoneal cavity should be more dreaded than the long slits, which are now made without compunction, for the removal of diseased ovaries, and so forth. There are, however, some conditions which even those who advise leaving the sac untouched, admit, require that it should be opened, namely, confinement of the protruded parts by entangling bands, or by adhesion to the sac itself, and a gangrenous condition of the bowel. Under all circumstances therefore I am still disposed to continue the practice of opening the sac, as I have hitherto done, believing it to be the most safe. I cannot conclude these observations without stating that I believe much of the fatality attendant on operations for strangulated ruptures, depends on the improper after-treatment. I well recollect the time when, as soon as the patient was put to bed, he was dosed with senna and salts, with the view of speedily procuring stools, and his already irritable bowels being thereby rendered still more irritable, he speedily sunk. Although this practice is probably less followed now than formerly, yet I am afraid there is still too great inclination to employ purgatives too early. For a few hours nothing more than a clyster should be given, and not even that, unless the patient be very uneasy in his bowels, and puffed up with wind. Not unfrequently they relieve themselves, and only after twelve or eighteen hours is it advisable to give medicine by the mouth, for the purpose of completely clearing the whole intestinal canal. And unless there be any special indication for calomel, I believe that castor oil is the best remedy of all.

Luke, who is a great advocate for Petit's operations, observes (*a*) that "the operation itself admits of a very brief general description. It consists of an incision of the integuments over the seat of the stricture, followed by a division of the subjacent cellular texture and *fascia*, to which succeeds the cautious division of the stricture itself; and afterwards the hernial contents are returned into the *abdomen*, as by the *taxis*, without exposure. In femoral and in umbilical *hernia*, for all practical purposes of the operation, the seat of stricture may be assumed to be at the respective abdominal apertures, although in the former *hernia* there is occasionally some light variation upon that point. * * * In inguinal *hernia* the seat of stricture is far more variable, and the range of its variation extends from the internal abdominal ring to the *scrotum* in the male; consequently, without some previous indication to guide the operator, the external incision may be made over one extremity of the range, when the stricture is far away at the other, and a fruitless search may be the probable result. * * * There are several ways of conducting the necessary examination to obtain the desired *diagnosis*, all of which depend for their success upon the stoppage of the communication of impulse from one part to another by the stricture. Thus, if the body of a hernial tumour be compressed by the hand, an impulse is communicated to all its parts below the seat of stricture; but if the neck of the *hernia* be grasped between the finger and thumb of the other hand, above the stricture, while such compression is made there will not be any impulse felt. When, in the commencement of the examination, the neck of the tumour is first grasped, we may be always assured, that if an impulse is felt on compression of the tumour itself, the seat of stricture is nearer to the *abdomen*; and by gradually withdrawing the finger and thumb in that direction, while renewed compression of the tumour is made, a point will be soon reached at which impulse ceases to be felt. The point at which impulse first ceases to be felt, is the seat of stricture. In like manner, if an impulse is not felt when the neck of the tumour is first grasped, we may be equally assured that the stricture is situated nearer to the body of the *hernia*; and, by a like gradual approximation to it with the finger and thumb, an impulse shortly commences to be felt. That point is the uppermost part of the strangulated contents, which implies that the stricture is immediately above it; and, on inquiry, it will be found to correspond with the indications of an examination commenced from below, as just mentioned; and thus the two modes of examination will tend to the correction of errors, to which each separately is liable. The same information may be obtained by attending to the point of cessation of impulse when

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(*a*) Operation for Strangulated Hernia; in Med. Gazette, vol. i. 1839–40.

the patient coughs; but this method is irksome and painful under circumstances of acute peritoneal inflammation, and on that account is not so generally desirable as that detailed. Yet much valuable information, not otherwise attainable, may be afforded by using this method in conjunction with that furnished by compression of the tumour. In some cases the stricture occupies a considerable portion of the neck of the *hernia*, but in most it is confined to a limited space. In the former case, before performing Petit's operation, it is desirable to be acquainted with those limits, in order that, when extensive, suitable provision may be made for its complete division. The combination of the two examinations has this knowledge for its object, which is easily attained by attending to the points of cessation of impulse. The point of cessation of impulse on coughing indicates the upper boundary of the stricture, and the point of cessation of impulse on compression of the *hernia*, indicates its lower boundary of the stricture; and, consequently, the boundaries are the limits of its extent." (pp. 865, 66.)

He further observes:—"The probability of the necessity to open the sac to effect a return, is much increased when the stricture is caused by its thick and indurated neck. * * * When the stricture is situated exteriorly to the sac, a director may generally be easily introduced under it, and it may be as easily divided with a bistoury; but when the neck of the sac itself forms the stricture, no such measure can be adopted. In such cases its division should be accomplished by cutting the indurated and thick substance on its exterior surface only, taking the greatest care that the knife does not penetrate to the interior of the sac. If this step has been properly performed, the division is only partial, and little amount of relief will ensue. To render the relief effective, the partial division of the indurated neck should be repeated in one or two other situations on the circumference of the stricture, by which, at length, the stricturing substance is so far weakened in its power of resistance, especially when unsupported by surrounding structures, that it becomes susceptible of dilatation by the very moderate interior pressure of the hernial contents during the efforts of the *taxis*. Success does not frequently attend the first efforts, so that renewed partial divisions, and renewed efforts, are mostly required; and, however unpromising such cases may be, experience enables me to state, that in this way they often admit of relief without the necessity of opening the sac. The proportion of failures in the attempt is, from its nature, greater than that which is experienced in *herniæ*, strictured by the margins of the abdominal apertures; yet, inclusive of these failures, I have not any reason to consider their general amount large, having sustained only five failures out of thirty-two cases, on which I have attempted to leave the sac unopened." (p. 866.)

There is much good in the preceding observations, on which account I have so largely quoted them; but the success resulting from this practice, so very far beyond what usually happens in cases of strangulated rupture, leads to the suspicion that some of the number mentioned, might, perhaps, have been relieved without other operation than the *taxis*.—J. F. S.]

1183. When the intestine has been properly returned into the belly, and the wound and surrounding parts cleaned, the edges of the wound must be brought together either with sticking plaster or with a stitch, covered with wadding, and a compress, and this dressing bound on with a suitable bandage. The patient should be put in such position that the belly shall be relaxed, with his chest raised, and his thighs drawn up; he must observe the strictest quiet, and take only mild mucilaginous drinks. In general some hours after the operation the bowels are relieved of themselves; but if this do not happen, an oily mixture may be given, castor oil, clysters, calomel, and if no inflammatory symptoms exist, an oily mixture, with common salt. The dressing must be replaced as often as necessary, and a slight compression made opposite the abdominal ring. When the wound has scarred, a proper truss is to be applied. If inflammatory symptoms occur, they must be treated antiphlogistically. If there be inflammation, consequent on still existing strangulation, or if protrusion of the intestine again happen, and it be painful to the touch, the part must be returned into the belly by introducing the finger. If symptoms of strangulation still continue, on account of entanglement of the intestine within the belly, its adhesion or narrowing, the intestine must be protruded by coughing, or by introducing the finger. If the strangulation still continue several days after the operation, and the intestines be still protruded on account of adhesion, it may then be advisable, in complete obstruction of the intestine, to open it with a lancet.

KEY (*a*) notices one circumstance in the after treatment, (especially in inguinal ruptures,) in which symptoms resembling those from strangulation occurred, viz., the transition of inflammation of the sac into suppuration. The *scrotum* swells up a day or two after the operation, becomes painful, hiccough and vomiting recur, the relief of the bowels is diminished or suppressed, and, from the fulness of the hernial sac, the patient has the sensation as if the rupture were again protruded. Distinct fluctuation is ordinarily not to be felt, on account of the thickening of the membranes. At first leeches and evaporating washes are to be applied, subsequently poultices, the closed wound is to be punctured with the lancet, and an escape made for the pus, *whereupon* the symptoms soon subside.

[I have had one case of suppuration of the sac of an inguinal rupture, but it did not cause any peculiar or dangerous symptoms, and after a few days emptied itself, and gave no further inconvenience.

I have once seen in a young man, operated on for scrotal rupture, and who was purged violently for some days, after taking five doses of two grains of calomel, with half a grain of opium every six hours, for *peritonitis*, inflammation extend from the sac up to the navel, and round into the right loin, which terminated in large sloughing of the cellular tissue; but he ultimately recovered.—J. F. S.]

1184. If the intestine be sloughy, it must be merely covered with a light compress dipped in a mucilaginous fluid. When all the slough is thrown off, and the artificial *anus* or fæcal fistula is formed by the union of the destroyed intestine with the neighbouring *peritoneum*, care is merely requisite for the due escape of the stools, the aperture is to be covered with wadding, and all pressure removed; the patient should take nourishing and easily digestible food; clysters and gentle purges should be often given.

[In general during the course of strangulation, the gut becomes so adherent to the mouth of the sac, that if it should mortify and burst, or if it be purposely opened by the Surgeon during the operation, it rarely recedes, and the stools, passing by the wound, form an artificial *anus*.

On the other hand an intestine may be returned into the belly, and slough afterwards. KEY mentions a case (*b*) under ASTLEY COOPER, in which strangulated inguinal rupture was operated on, "and the intestine, though dark-coloured, appearing to be merely congested, was returned into the *abdomen*. In the evening of the same day he passed stools *per anum*, and appeared relieved. On the third day, as soon as the poultice was removed, a quantity of fæculent matter was seen issuing from the opening; the discharge of *fæces* continued for five days, at the end of which time it altogether healed, and the wound speedily cicatrized." In another case, a strangulated congenital rupture, which occurred to KEY himself: on the fourth day after the operation "a copious discharge of *fæces* had taken place at the wound. The *abdomen* had remained tender since the operation, but he had discharged *fæces per anum*. The discharge did not cease for several days, and delayed the healing of the wound. But at the end of about sixteen days, he became convalescent, and the wound entirely closed." (pp. 111, 13.) LAWRENCE mentions a remarkable case of bubonocele, which was operated on by RAMSDEN:—"The gut, which was much discoloured, was returned without difficulty, but seems not to have completely re-entered the abdominal cavity. On passing the finger as high as the incision would admit, if it did not fairly reach the *abdomen*, it seems as if the intestine, although free from stricture, were contained in a peculiar membranous bag." Clysters, which were ordered, could not be forced up, which led to examination of the *rectum*, and thence some hardened *fæces* were removed. She was much exhausted, but, by care, had considerably recovered next morning, and the bowels not having been moved, calomel and colocynth extract were given every two hours, which, in the evening, began to operate, and before morning she had eight or ten stools. She continued for a time in a very fluctuating state, but well-grounded hopes of her recovery were entertained till "she was seized, in about six weeks after the operation, with violent pain in the lower part of the *abdomen*, which terminated in two days in a discharge of *fæces* from the wound, and perfect ease. The appetite now failed, the strength decreased, and death took place on the tenth day from the appearance

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(*a*) A. COOPER's Hernia, p. 58, *note*.

(*b*) Memoir.

of *fæces* in the wound. On *examining* the body, the whole of the intestines were found so strongly adherent to each other, that they could not be separated without laceration. A portion of the *ileum*, the same, probably, which had been protruded, adhered to the abdominal ring. Its coats were greatly stretched, and its canal was much contracted. A small ulcerated aperture was discovered in this part; and led, in a fistulous form, through a substance nearly equal in size to the little finger, to the external wound." (p. 328.)

It has been well observed by Key, that "cases are sometimes met with in which the patient appears to be doing well after the operation, the evacuations being free and natural, and the sickness and pain subsiding; but after the lapse of two or three days the powers begin to sink, the *abdomen*, though not very tense, is uneasy under pressure, the pulse small and quick, and the tongue becomes dry and coated. This condition is, perhaps, protracted for several days, and the patient at length dies. A *post mortem* inspection discovers the cause of death in the dark colour and lacerable condition of the strangulated portion of the bowel and the vascular state of the surrounding parts. This unexpected termination of a case, when it does occur, usually takes place in patients of enfeebled constitution, whose powers are unequal to the restoration of the healthy circulation in the strangulated bowel after its release from the stricture; and in whom, therefore, a slight degree of inflammation gradually ends in the extinction of its vitality. At the period of the operation the intestine, when exposed, presents none of the usual indications of present or approaching gangrene; no infiltration of its tissues, no discoloration beyond that which retarded circulation in a healthy bowel produces, no lack of peritoneal lustre, and no lacerability of texture; it in no point appears to differ from those cases of strangulation, in which an early operation is had recourse to before severe symptoms come on, and in which a favourable *prognosis* is verified by a rapid convalescence. Exposure

Tabular View of Operations

	Kind.	Sex.	Age.	Duration.	Truss.	Strangulation.	Vomiting.	Constipation.
1835. I. Aug. 17	Right scrotal, not small.	Male .	43	From childhood, but not congenital.	Worn for last seven years.	11½ hours	Seven hours, little.	Not mentioned how long.
1836. II. May 10	Left direct scrotal, (also on other side,) size of pigeon's egg.	Male .	73	15 years	. . .	3 days .	Constant . .	3 days . .
III. Oct. 29	Scrotal, large as child's head of two years.	Male .	45	19 years	. . .	12 hours .	Symptoms not urgent.	
1837. IV. Jan. 24	Scrotal, left, (also on other side,) size of an orange.	Male .	82	40 years, (incarcerated.)	. . .	4 days .	None . . .	4 days . .
V. Sept. 24	Femoral, right double sac.	Female	56	9 years	Four years cup-truss.	3 days .	Much . . .	3 days . .
1838. VI. Sept. 27]	Scrotal, right, as large as a pear.	Male .	46	2 years	For some time . (Symptoms of strangulation scarce, so that I did not operate for 24 hours.)	36 hours .	Slight . . .	24 hours naturally, but since by clyster.

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* Upon these cases I operated in St. Thomas's Hospital during the first four and a half years of my quent severe illness has twice broken in on me, and prevented me keeping so regular an account since; from such tables.—J. F. S.

ı portion of bowel possessing such feeble powers of resistance to morbid influence not but tend to increase, probably to excite, a disposition to inflammation; which, ugh low in degree, is sufficient to destroy its vitality: and it may therefore be fairly arded as the main agent in the production of gangrene." With this explanation I not agree; the mischief has been done to the bowel, or at least its foundation is laid, elieve, before the sac is opened, by the disturbance of the circulation during the ıngulation, from which the bowel has not power to recover itself; and according as stagnation of the blood has existed for a shorter or longer time, and to a less or ater extent, so does the mischief run on subsequently to inflammation and gangrene. . F. S.

In cases in which great depression of the powers is observed to precede the operaı," continues KEY, " death sometimes rapidly takes place without any other obvious se than the exposure of the bowel. The condition of the patient is often found to be nifestly worse after the operation, and stimulants are obliged to be plentifully admiered, in order to sustain the sinking powers of life. This may happen without ammation of the abdominal cavity or gangrene of the bowel; and is attributable solely he depressing effect of the operation. The pulse, which before the operation was ɔle, becomes fluttering, and scarcely perceptible; the countenance, which was anxious, v bespeaks the approach of death; the skin is covered with a clammy moisture, and whole frame is seized with a restlessness that gradually ends in the calmness of solution." (p. 51–4.)

ASTLEY COOPER mentions the very remarkable circumstance of *tetanus* follow- the operation for rupture, on the eighth day, by which the patient was speedily troyed (*a*).]

(*a*) Above cited, p. 58.

*trangulated Rupture.**

Tenderness.	Contents.	Bowels moved.	Result.	Additional Remarks.
little, of rupture	Eight inches gut only, bright and turgid, thickened.	Freely within an hour.	Cured.	
ly much, with ɔrdial pain and ugh from first which continued ird day after opeı, and pain in ceased.	Sac divided by vertical *septum*, *omentum* before, gut behind; two inches gut, bright chocolate-coloured.	After 24 hours free motion from repeated clysters; the bowels continued to be moved, but though assisted with stimulants and nourishment, he gradually sunk.	Died on ninth day; intestine at mouth of sac still dark-coloured, little inflammation.	Large quantity of fat between cremaster and sac. I wounded intestine in opening sac with knife.
ɔture, probably attempts at reɔn.	Half yard of intestine, front half of which chocolate and thickened, other unaltered; also large mass of *omentum*.	A slight motion from clysters after 24 hours; after same interval, and castor oil and clyster, bowels moved freely.	Cured (stricture not tight.)	Attempts were made to diminish size of rupture by application of ice, but without avail. The dresser had also given tartar emetic. The *omentum* was left. The gut came down again on ninth day, in getting out of bed, but slowly returned.
upture a little .	Much adhering *omentum*, almost schirrous; a small portion of *colon* healthy.	In eight hours after two clysters some *scybala* came away. Next morning he had calomel and castor oil, and the bowels were freely moved.	Cured (stricture none, but without dilating.)	Ice was applied for three hours before operation without benefit. Dilated the stricture and left the gut, but tore and cut off *omentum*. Probably in this case the *colon*, together with its peritoneal connexion to the iliac pit, descended, but I did not notice this at the operation.
belly; has had ugh throughout day; tenderness l on second day.	Bit of *omentum*, size of a walnut, in little sac; four inches choc. intest., shining, but slightly adherent, and much matted *omentum* in large sac.	An hour after, the bowels very freely opened, and again three hours after.	Cured (stricture not very tight.)	The larger piece of *omentum* was cut off.
belly nor in re.	Three inches chocolate, with a little patch of adhesive; no *omentum*.	Within eight hours after twice castor oil, very copious motions.	Cured (stricture very tight.)	Cremaster enormously thickened.

tant Surgeonship; and it will be observed that for one whole year I had not a single case. Subsehope yet to resume and continue a similar one, as I am convinced of the advantage which accrues

	Kind.	Sex.	Age.	Duration.	Truss.	Strangulation.	Vomiting.	Constipati
1838. VII. Nov. 4	Femoral, right, of large size and oblong form on POUPART's ligament, then bending down and extending into *labium*.	Female	55	10 years	Truss not fitting	10 hours .	Much throwing up of wind, but no vomiting.	36 hours .
VIII. Nov. 28	Right scrotal, congenital; three fingers thick, one long.	Male .	22	Says he has only noticed the swelling 12 months.	Suspensory . .	12 hours .	Much . . .	24 hours .
IX. Nov. 29	Femoral, (right,) not large, but flaccid.	Female	43	12 years	Six weeks . .	47 hours .	Much . . .	47 hours .
1840. X. April 18	Femoral, (right,) swelling large.	Female	62	24 years	Partially irreduc.	23 hours .	Much . . .	36 hours .
XI. June 15	Umbilical, (as large as a half-quartern loaf,) with cleft, so as to have hour-glass form.	Female	60	12 years	Partially irreduc., no truss.	30 hours .	Much, twelve hours.	36 hours .
XII. July 4	Femoral, (right,) always small.	Female	57	20 years	No truss . . .	3 days .	Much, three days.	5 days
XIII. July 30	Scrotal, (left,) size of pigeon's egg.	Male .	60	14 years	Has worn . .	6 hours .	Much . . .	. . .
XIV. Aug. 16	Scrotal, (right,) also on left.	Male .	59	54 years on left, 18 on right after blow.	Has worn . .	26 hours .	Much . . .	36 hours .
XV. Oct. 29	Femoral, (right,) size of pigeon's egg.	Female	45	20 years	Has worn till within last three years.	4 days .	36 hours, much	4 days

Tenderness.	Contents.	Bowels moved.	Result.	Additional Remarks.
er part of belly, the swelling.	*Omentum* in *labium* soft, but in true sac firm and matted; in true sac knuckle of bright gut.	Within first nine hours the bowels thrice sparingly relieved by clyster. She went on very well, but the bowels were not satisfactorily moved till four days after the operation, although she had calomel and opium twice a-day, with occasional castor oil and senna and salts.	Cured, (stricture very tight.)	The inside of the sac had probably burst, and allowed the gut to escape into the *labium*.
belly, tender- f rupture.	Two inches gut dark-coloured, bright.	Bowels moved by clyster and castor oil freely between 12 and 16 hours after operation.	Cured, (stricture at internal ring very tight, and like movable membranous ring.)	
pain in belly pressed.	Healthy, bright, and dark coloured gut.	Nine hours after operation bowels freely moved by clyster.	Cured, (stricture tight.)	
ain in belly, and relieved by the tion; no pain nor rness in swelling.	Much adhering *omentum*, four inches of intestine very dark, but shining.	A few *scybola* brought away by clyster 22 hours after operation, but nothing more.	Died 18 hours, (stricture very firm.)	Fetid smell on opening the sac. The adhering *omentum* was left alone. The vomiting continued after the operation almost to the last. On *examination*, the intestine gangrenous, with mark of separation; intestines slightly glued.
g tender . . .	Sac divided by transverse band; hard mass of *omentum*, adherent in upper portion; eight inches of dark chocolate bright intestine.	Bowels relieved of thin motion 30 hours after operation, not without calomel and opium every two hours seven times; a single dose of calomel and clysters had previously been useless.	Died 48 hours, (stricture not tight.)	Fetid smell before opening the sac. A deep tough band of cellular tissue indented the hernial sac, which also had a corresponding deep fold. Vomiting continued till death. On examination, the intestine dirty clay-colour; no *peritonitis*.
ut not tenderness, belly.	Very small knuckle of dark-coloured bright gut.	Three hours after operation a few small *scybola* after clyster, but after castor oil the bowels were freely moved during the day; purging came on on third day.	Died 65 hours, (stricture very tight.)	No account of examination.
pain in belly . .	Large knuckle of dark gut, very tense, and peritoneal coat seemed cracked.	Bowels twice moved within 12 hours by castor oil.	Cured, (stricture very tight.)	
pain in belly; after ation complained ain about navel, h did not subside.	Half yard of gut, not deep-coloured, but much thickened and slightly ecchymosed.	Within 24 hours his bowels freely moved by clyster; after which they continued tolerably regular. Calomel and opium were given every six hours, and when his powers began to fail, brandy and arrow-root.	Died six days after, (stricture not tight, but required division, as also a band below it.)	The *scrotum* very large, much reddened, probably from efforts and crackling. Much difficulty in returning gut on account of its thickness. In course of the second day hiccough came on, and some sickness, which subsided, but came on next day, and frequently after to the last. Nor was it checked but slightly by hydrocyanic acid. On examination, all the intestines were found glued together; strangulated gut not restored; suppuration between cremaster and sac.
pain in belly, with pany.	Mass of healthy *omentum* adherent, small bit of reddened but not dark gut, size of top of thumb.	The bowels were not moved till a few hours before death.	Died 36 hours, (stricture tight.)	She was, when first seen, very much depressed, and the surface cold. Three or four ounces of straw-coloured fluid escaped from the belly after reduction, immediately on the return of the gut. The *omentum* left in sac. Calomel and opium were ordered directly after the operation on account of the pain and tenderness of the belly. Egg and brandy, and other nourishment were given without avail. Slight *peritonitis*; only a portion of intestinal tube, size of sixpence, had been strangulated, and lay just above mouth of sac.

Second Chapter.—OF ABDOMINAL RUPTURES IN PARTICULAR.

I.—Of Inguinal Rupture.

(*Hernia inguinalis*, Lat.; *Leistenbruch*, Germ.; *Hernie inguinale, Bubonocèle*, Fr.)

Camperi, P., Icones herniarum inguinalium, edit. a S. Th. Soemmerring. Francof., 1801.

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Rudtorffer, F. X., Abhandlung über die einfachste und sicherste Operationsmethode eingespenter Leisten-und Schenkelbrüche; nebst einem Anhange merkwürdiger, auf den operativen Theil der Wundarzneikunst sich beziehender Beobactungen. Wien, 1805. 8vo. 2 vols.; with eight plates.

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————————, neueste anatomisch-pathologische Untersuchung über den Ursprungund das Fortschreiten der Leisten und Schenkelbrüche. Würzburg, 1815. 4to.; with fifteen copper-plates.

Wattmann, Ueber die Vorlagerungen in Leistengegend. Wien, 1815.

Langenbech, Commentarius de structura peritonæi, testiculorum tunicis, eorumque ex abdomine in scrotum descensu; ad illustrandam herniarum indolem. Götting., 1817. fol.

—————, Abhandlung von den Leisten-und Schenkelbrüchen, enthaltend die anatomische Beschreibung und Behandlung der selben. Götting., 1821; with eight copper-plates.

Meckel, J. F., Tractatus de morbo hernioso congenito singulari et complicato. Berol., 1772.

Sandifort, Icones herniæ inguinalis congenitæ. L. B., 1788. 4to.

Wrisberg, Observationes anatomicæ de testiculorum ex abdomine in scrotum descensu, ad illustrandam in chirurgia de herniis congenitis utriusque sexus doctrinam; in Comment. Soc. Reg. Scient. Götting., 1778.

Sinogowitz, Anleitung zu einer zweckmässigen Manualhülfe bei eingeklemmten Leisten und Schenkelbrüchen. Danzig, 1830. 8vo.

Zahner, Chirurgische Anatomie der Bruchstellen am Unterleibe; inaug. Abhandl. Erlangen, 1833.

Hammond, William, Anatomy and Surgery of Inguinal and Femoral Hernia. London, 1834. fol.

Also the writers before mentioned.

1185. *Inguinal Rupture* passes through the *abdominal ring* (*annulus abdominalis*); it may be either *Scrotal*, (*Hernia scrotalis*, Lat.; *Hodensackbruch*, Germ.; *Oscheocele*, Fr.,) when descending into the *scrotum*, or *Labial*, (*Hernia labii pudendi externi*, Lat.; *Bruch der äusserer Schaamlippe*, Germ.; *Hernie des grandes lèvres*, Fr.,) when passing into the *labium*.

1186. The *front* or *outer abdominal ring* is the external opening of the *inguinal canal*, (*canalis inguinalis*,) and is formed by the tendon of the external oblique muscle stretching from the upper front spine of the hip-bone to the pubic *symphysis*, (Poupart's *ligament*, or the *external inguinal ligament* of Hesselbach,) where the fibres separating, attach themselves by one part (the *inner pillar of the ring*) to the pubic *sym-*

physis, and by the other (the *outer pillar of the ring*) to the spine of the share-bone. A triangular opening is thus formed, of which the share-bone is the base, and the point inclining upwards and outwards is the junction of the two pillars. By the splitting of the muscular fibres of the internal oblique abdominal muscle, the junction of its tendon with that of the transverse muscle, forms the other part of the inguinal canal. The internal opening of the inguinal canal (*hinder* or *inner abdominal ring*) is formed by an *aponeurosis*, (the *fascia transversalis* of Cooper, the *internal inguinal ligament* of Hesselbach, *the external layer of the peritoneum* of Langenbeck,) commencing from the hinder edge of Poupart's ligament, which seems to twist itself upwards and backwards. This *aponeurosis* loses itself above in the cellular tissue which overspreads the inner surface of the transverse muscle, and is continued to the under surface of the diaphragm. Internally it arises from the outer edge of the tendon of the straight muscle, which unites with it, and therefore at this part it is strongest. Where the strong fibres of this *aponeurosis* ascend obliquely outwards over the femoral vessels, they form an oblong aperture for the passage of the spermatic cord (which, according to Cloquet, is covered by this *aponeurosis*, to the testicle, where it is connected to the vaginal tunic) (1). The inguinal canal is directed from without and above, inwards and downwards, as it passes from the hinder or inner to the front or outer ring, and is from one inch and a quarter, to an inch and a half long. Its front wall is formed by Poupart's ligament, and a small part of the internal oblique muscle; its hind wall inwards and upwards by the delicate fleshy bundles of that muscle, and below and without, by the *fascia transversalis*. In the male the spermatic cord passes through the inguinal canal, and is surrounded besides by the process of the transverse *fascia*, by cellular tissue, and covered by the cremaster muscle, (the lengthened fibres of the internal oblique muscle,) the general vaginal tunic, (*tunica vaginalis communis*, according to Langenbeck,) a process of the external layer of the *peritoneum*. The external surface of the external oblique muscle is covered with a delicate aponeurotic expansion considered to be a process of the *m. fasciæ latæ femoris*, and which spreads over the front inguinal ring and the spermatic cord (*tunica dartos*, *fascia superficialis* of Cooper) (2). The epigastric artery arises from the external iliac above Poupart's ligament, ascends between the transversal *fascia* and the outer layer of the *peritoneum*, inwards and upwards, on the inside of the hinder or inner inguinal ring, there crosses the spermatic cord, reaches the edge of the straight muscle about an inch and a half from its origin, and runs upwards on its hind surface. If the region of the groin be examined on the peritoneal side, the trace of the obliterated vaginal tunic is seen at the point which corresponds to the hinder inguinal ring, and in many cases there is a depression in the *peritoneum*, which indicates the upper part of that tunic remaining open; on the inner side of this spot lies the epigastric artery. Between this and the umbilical artery, opposite the front or outer inguinal ring, is seen a slight depression, (inguinal pit, *fovea inguinalis* of Hesselbach,) where the *peritoneum*, towards the external ring, is covered only by the weaker parts of the transversal *fascia*, and by the delicate bundles of the internal oblique muscle.

[(1) The description of that most important part in ruptures, both inguinal and femoral, namely, the *fascia transversalis*, is not given by Chelius so clearly as might be; for it is far less difficult either to dissect or describe than commonly considered. At the onset it must be remembered that it is not a tendinous, but merely a cellular membranous structure, much condensed, and connecting the whole hind surface of the abdominal muscles with the front of the *peritoneum.* It is not part nor process of POUPART's ligament, but simply attached to it by one of its processes, whilst the other descends behind it, the former commonly called the iliac, and the latter the pubic portion of the *fascia transversalis.* The iliac portion commences by a sharp angle at the outside of the pubic spine, and ascends outwards, closely attached to the back and upper edge of POUPART's ligament to the upper front spine of the hip-bone, gradually increasing in width, and having a scythe-like shape, with the edge upwards and inwards, to the middle of that ligament, where it suddenly spreads upwards and is interposed between the back of the abdominal muscles and the front of the *peritoneum,* and is said to be lost on the diaphragm, which, however, is not really the case, for it continues as the connector of the *peritoneum* with that muscle, and then descending upon the front of the loins connects it with the lumbar muscles, and runs down upon the *iliacus* muscle on either side, between them and the *peritoneum,* and having attained those regions assumes the name of *fascia iliaca,* where for the present it must be left. I have said that the iliac portion of the *fascia transversalis* was scythe-shaped to the middle of POUPART's ligament, and it is there, about an inch in depth. It then runs inwards and descends behind the lower part of the straight muscles, is fixed to the back of the pubic bones, as far as their spines, spreads out on either side beyond them, behind and connected but slightly with the scythe-like portion, up to the upper front spine of the hip-bone ; this from its attachment is called the pubic portion of the *fascia transversalis,* and its shape is more sickle-like, with the concavity upwards and outwards. The sudden turning inwards and downwards, and afterwards outwards and upwards of the pubic portion unconnected, or but loosely connected with the iliac portion of the *fascia transversalis,* leaves a gap about an inch and a half above POUPART's ligament, the hinder or inner abdominal ring, which has a sort of oval shape, or rather like the periphery of the vertical section of a pear.

That part of the pubic portion from below the inner ring to the spine of the share-bone, and behind the scythe edge of the iliac portion of the *fascia transversalis,* alone forms the floor or back of the inguinal canal, down to the upper edge of the external ring, but between this and its connexion to the spine, and *symphysis* of the share-bone, it is strengthened by the lower ends of the conjoined tendons of the internal oblique and transverse muscles, which descend in front of and closely connected with it, to be fixed from the spine to the *symphysis* of the share-bone, and thus together they shut like a window-shutter against the back of the external ring. A little shallow triangular groove extends from the internal to the external ring formed by the scythe edge of the iliac portion in front, and the pubic portion of the *fascia transversalis* behind, and in this as in a gutter lies the spermatic cord or the round ligament.

It must not be supposed that the inner ring is an actual aperture, except during the descent of the testicle, and then indeed it is only the orifice of a cellular pouch thrust down below the pouch of the *peritoneum,* which subsequently forms the vaginal tunic of the testicle ; and when, after the arrival of that organ in the *scrotum,* the *peritoneum* upon the cord gradually closes and thins, so likewise does the pouch of the *transversalis fascia,* forming the *fascia* of the cord, described by ASTLEY COOPER long before CLOQUET's account of it. In addition to this *fascia* from the inner ring a similar funnel of cellular tissue from the outer ring is given off as the cord passes through it, and the two *fasciæ* so called become confounded into one below, between the external ring and the testicle.

(2) The superficial *fascia* or *aponeurosis* of the external oblique muscle is not tendinous, but merely the cellular tissue which connects the skin with the front of the abdominal muscles, and descends upon the spermatic cord and testicle to connect them with the skin of the *scrotum.*—J. F. S.]

1187. At these two points inguinal ruptures are formed, and upon the difference in their origin depends their division into *external* and *internal,* or *oblique* and *direct* of English Surgeons.)

1188. *External or Oblique Inguinal Rupture* (*Hernia inguinalis externa,* Lat. ; *Aüssere Leistenbruch,* Germ. ; *Hernie inguinale externe,* Fr.) commences at the seat of the obliterated canal of the vaginal tunic, or the intestines pass into the canal itself, which remains partially or completely open. This rupture proceeds from above and without, inwards and downwards, in the direction of the spermatic cord, as a cylindrical swelling; the spermatic cord lies on its inner hinder side, and the epigastric artery passes under the neck of the hernial sac and upon its inner side; if it be returned, a peculiar gurgling is heard.

1189. *Internal or Direct Inguinal Rupture (Hernia inguinalis interna*, Lat.; *Innere Leistenbruch*, Germ.; *Hernie inguinale interne*, Fr.; *Ventro-inguinal Hernia* of COOPER) passes out of the inguinal pit directly from within outwards through the external inguinal ring; it has a peculiar rounding, a short neck; it raises the inner pillar of the abdominal ring considerably; the spermatic cord lies on the outer side of the swelling; no gurgling is heard on its return.

1190. The symptoms by which external and internal inguinal ruptures are distinguished from each other, are only certain at the commencement of their existence, and whilst they have yet no great size. When the external inguinal rupture has become very large, it completely loses its cylindrical form, its oblique narrow neck, and passes directly out of the cavity of the belly. The position of the spermatic cord in old ruptures is equally various; not unfrequently are the vessels separated from each other by the pressure of the swelling.

1191. External or oblique inguinal rupture passes through the hinder (inner) inguinal ring into the general vaginal tunic, and may descend to the testicle, the proper vaginal tunic of which it touches. Its own coverings therefore are, 1, the skin of the *scrotum;* 2, the *fascia superficialis;* 3, the *tunica vaginalis communis*, upon the upper surface of which spread the fibres of the cremaster muscle; 4, the hernial sac itself, an unnatural lengthening of the *peritoneum*, covered on its outer surface with loose cellular tissue. In old ruptures these layers are often of considerable thickness.

Sometimes the external inguinal rupture does not pass through the front inguinal ring, but remains lying in the inguinal canal; it is then called *imperfectly developed inguinal rupture* (*Rupture in the inguinal canal* of English Surgeons.) It forms in (above) the middle of POUPART's ligament, above (before) the crural artery, a round or obliquely oval swelling, which becomes larger by coughing, is accompanied with an unpleasant sensation of pressure and dragging, and easily thrust back on application of the finger. The external inguinal ring is free. If the rupture increase, it descends obliquely inwards and downwards, towards the external inguinal ring, and passes through it. But it often exists as an undeveloped inguinal rupture, and spreads upwards and outwards. Besides the coverings already mentioned, this is covered with the front wall of the inguinal canal; to wit, the tendon of the external oblique, and the muscular fibres of the internal oblique muscle (1).

[(1) It is not covered by the muscular fibres of the internal oblique, for as soon as the rupture is formed by protruding through the upper or internal abdominal ring, the muscular edge of the internal oblique and transverse muscles slips back, and rests upon the upper and back part of the swelling.—J. F. S.]

1192. The internal or direct inguinal rupture projects at the inguinal pit, either between the fibres of the *fascia transversalis*, and the thin bundles of the internal oblique abdominal muscle, or protrudes with it the *fascia transversalis;* it drives down external to the vaginal tunic into the *scrotum*, and if it sink lower than the spermatic cord, the testicle rests upon the fore or outer part of the body of the hernial sac. The coverings of this rupture are, 1, the skin of the *scrotum ;* 2, the superficial *fascia ;* 3, sometimes some bundles of the cremaster muscle (*a*) ; 4, sometimes the transverse *fascia* (*b*) ; 5, the hernial sac, with its external surface covered with loose cellular tissue.

(*a*) As long as internal inguinal rupture is not far from the abdominal ring, it is not covered with the cremaster ; but in great protrusion it can incline farther outwards, and then it is possible that some fibres of the cremaster may appear on it, beneath which it simultaneously slips down.

(*b*) This usually appears to be the case, and the cause why the internal inguinal rupture can never attain the size of the external.

1193. It must be considered as a strong disposition for inguinal rupture if there be only a partial remaining open of the upper part of the vaginal canal for the outer, and a great elevation of the duplicature of the *peritoneum,* in which the umbilical artery lies, for the inner inguinal rupture.

1194. The *ileum* is the most common intestine in inguinal rupture, next it the *cæcum* and its wormlike process. If the *cæcum* or *colon* protrude, the ligaments are lengthened which connect them to the *peritoneum*, and also that part of the *peritoneum* which is connected with the intestines is drawn down, so that between the hernial sac and the intestines there is the same natural connexion as existed in its previous position. In these ruptures of the *cæcum* and *colon*, part lies externally to the sac, as in the belly it had lain external to the *peritoneum.* In general the hinder or under part of its calibre is protruded ; as it drops down however the intestine often twists, so that its bare part lies in front, in which case the rupture seems to have no hernial sac. The *omentum* commonly passes into an inguinal rupture, especially on the left side. With the internal inguinal rupture a portion of the urinary bladder sometimes protrudes, which cannot be drawn from the sac. In rare cases, in women, the internal generative organs are contained in inguinal rupture. Inguinal ruptures are much more frequent in men than in women. The frequency of internal to external inguinal ruptures is as one to fifteen.

1195. If the intestine pass *into the still open canal of the vaginal tunic* of the testicle, it is called a *Congenital Inguinal Rupture* (*Hernia inguinalis congenita seu processus vaginalis*, Lat. ; *angeborner Leistenbruch*, Germ. ; *Hernie inguinale congénitale*, Fr.) The origin of congenital inguinal rupture depends, in addition to the vaginal tunic remaining open, upon special causes :—*first*, on the long continuance of the testicle in the external inguinal ring, because then the vaginal canal has less disposition to be obliterated ; *second*, after birth the protrusion is always favoured by respiration and by the action of the abdominal muscles ; *third*, by adhesion of the testicle with the *omentum*, or with the intestine, previous to its descent, or if the intestine be connected with the *peritoneum*, as the *cæcum* on the right side, it may be drawn down with it.

1196. Congenital inguinal rupture has the same relations as external or oblique inguinal rupture, but is distinguished by the following circumstances, *first*, the common external inguinal rupture does not descend over the place where the general vaginal tunic is connected with the testicle ; in congenital rupture the intestines touch the testicle, and can thrust it upwards and backwards ; *second*, congenital rupture develops itself more as the hernial sac is not formed by the early gradual elongation of the *peritoneum.*

1197. The coverings of congenital inguinal, are the same as those of external or oblique inguinal rupture, except that the hernial sac is formed by the *tunica vaginalis propria*. In rare cases a second lengthening of the *peritoneum* may descend into the still open canal of the vaginal tunic, by which the intestines descending into this sac are separated from the testicle (*a*). The congenital inguinal rupture is mostly intestinal, because the *omentum* is very short; it may however contain a portion of *omentum* if it have been adherent to the testicle in the belly (1).

Narrowing of the hernial sac occurs most frequently in congenital inguinal ruptures, and consequently often several nearly perfectly closed hernial sacs are formed (*b*).

[(1) This is ASTLEY COOPER'S *Encysted Hernia of the Tunica Vaginalis,* in which "on opening the *tunica vaginalis*, instead of the intestine being found lying in contact with the testicle, a second bag or sac is seen enclosed in the *tunica vaginalis*, and enveloping the intestine. This bag is attached to the orifice of the *tunica vaginalis*, and descends from thence into its cavity; it generally contracts a few adhesions to the *tunica vaginalis*, whilst its interior bears the character of a common hernial sac." COOPER considers that in this case "the *tunica vaginalis*, after the descent of the testicle, becomes closed opposite the abdominal ring, but remains open above and below it. The intestine descends into the upper part, and elongates both the adhesion and *tunica vaginalis*, so as to form it into a bag, which, descending into the *tunica vaginalis* below the adhesion, and becoming narrow at its neck, though wide at its *fundus*, receives a portion of intestine. * * * The disease does not appear like *hernia* of the *tunica vaginalis*, as the *testis* is not involved in it, but can be distinctly perceived below it. * * * The strangulation arises from the contracted state of the mouth of the hernial sac." (p. 79-80.)]

1198. Various swellings which occur in the inguinal region must be distinguished from ruptures; such are *hydrocele*, *varicocele*, *inflammatory swelling of the spermatic cord*, *arrest of the testicle at the abdominal ring*, *collections of fat in the cellular tissue of the spermatic cord*, *collection of pus*.

1199. It is hardly possible to mistake a collection of water in the *tunica vaginalis propria* for a rupture. If the *hydrocele* be large, it may extend up to the abdominal ring and seem to penetrate within it, but if the swelling be drawn a little down, it will be seen that it does not lie in it, and that the ring is in its natural condition. In *hydrocele* the swelling ascends gradually towards the abdominal ring. The functions of the intestinal canal are undisturbed; lying on the back and coughing have no effect on the swelling. Congenital *hydrocele*, where indeed water is collected in the canal of the vaginal tunic, has greater resemblance to rupture; however, the consistence of the swelling, its transparency, its more easy or more difficult reduction, its quicker or slower reprotrusion, give the explanation (1). The diffused collection of water in the cellular tissue of the spermatic cord (*Hydrocele tunicæ vaginalis communis*) has the greatest resemblance to an omental rupture. The swelling which originates along the spermatic cord is broader below than above, seems to diminish on slight pressure, though it recurs immediately the pressure is withdrawn on lying down and standing up. If there be fluctuation, it is only at the bottom; if the bottom of the swelling be pressed, the fluid gently rises towards the apex, and expands it. If the swelling be within the abdominal ring, it stretches it; the patient often feels a pain at some part, and a dragging in the loins. As a distinctive character from omental rupture, it must be remembered that *hydrocele* of the cord has less con-

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(*a*) HEY, Practical Observations in Surgery. London, 1814, p. 226.—COOPER, ASTLEY, above cited.—MECKEL, Handbuch der Pathologischen Anatomie, vol. ii. pt. i. p. 379.

(*b*) CHELIUS, Ueber Verengerung des Bruchsackes bei angebornen Brüchen; in neuen Chiron. vol. i. pt. i.—LIMAN, Beobachtungen über das normwidrige Verhalten des Bruchsackes; in Journal VON GRAËFE und VON WALTHER, vol. v. pt. i. p. 97.

sistence and a less irregular surface than omental rupture ; it is also usually somewhat broader at the base, whilst in omental rupture the contrary occurs (*a*).

[(1) Although hydrocele of the common kind, namely, that in the vaginal covering of the testicle itself, cannot, without great carelessness, be mistaken for scrotal rupture, as its slow formation, its commencement from below instead of above, and its transparency sufficiently characterize it; yet if the hydrocele be situated in the cord itself, it may, at first sight, be thought to be a hernial swelling, especially as it seems to begin at the top instead of the bottom of the *scrotum*, and the patient's account of its origin is often very confused. I have seen three or four cases of this kind, and the last which I had under my care presents a very good example of the usual occurrences in this complaint.

Case.—W. H., aged thirty-five, a healthy carpenter, was admitted

May 30th, 1845, and says, he had never any swelling in his groin till three weeks since, when, as he was lifting a heavy weight, he suddenly felt something snap in the left groin ; but he suffered neither pain nor uneasiness, and continued his work during the rest of the day, without further noticing it. On rising next morning, however, he observed a small tumour, about the size of a filbert, in the left groin, which he says entirely disappeared when he was lying down on his back, and was capable of reduction when he stood upright. He was told the swelling was a rupture, and advised to wear a truss, for which he applied to a maker, who being unable to return the swelling, applied the truss upon it five days ago ; from which to the present time he has continued to wear it, but the swelling increasing in size and becoming painful, he applied to a practitioner, who considering the disease to be an irreducible rupture, sent him to the hospital. The swelling was in the course of the left spermatic cord, about the size of a hen's egg, and extended up to the external ring and down to the testicle ; above it the cord could be grasped, the finger and thumb almost meeting ; it was firm and elastic ; very tender to the touch (probably from the irritation of the truss) ; and a portion of it about the size of a walnut, was transparent. From these circumstances I was led to believe it a hydrocele of the spermatic cord. Some, however, might suppose, as it arose so suddenly, that the swelling was caused by tearing of one or more lymphatic vessels whilst he was exerting himself. Nothing further was done than applying hot flannels to the swelling, keeping him in bed, and giving him a dose of opening medicine. In the course of six days it had diminished to the size of a nut, and at the end of a fortnight had entirely disappeared.

A boy, aged six years, was brought to the hospital

May 5, 1838, considered to have strangulated rupture. He has worn a truss for several years. His bowels have not been moved for the last three days, and he has vomited several times, but not since yesterday morning; neither has medicine, which he then took, been rejected, although it has not operated. The right side of the *scrotum*, as far as the *raphe*, is distended with fluid, semi-transparent and œdematous ; its shape flat, and much the form of the testicle ; it is firm, but indents on pressure of the fingers, and reaches up to the abdominal ring, where it narrows. I could not satisfy myself as to the existence of any rupture, but thought it had the appearance resembling what I should suppose a burst hydrocele might assume. His mother took him away, promising to bring him back ; but he never returned.

Very recently a similar case to the first was received into the hospital, and as in it, the cord could be grasped between the swelling and the external ring ; but some doubt of its nature being entertained, a cut was made into it, some straw-coloured serum escaped, and the cyst found to be closed and quite free from the belly.

Sometimes these hydroceles of the cord may result from the patient having worn a truss sufficiently long to produce adhesion of the mouth of the sac and shut off the lower part from the belly without its cavity being obliterated. Sometimes after the adhesion of the mouth of the sac, it may be again thrust down, either partially along the cord, in which case there may be a collection of water in the old sac, between the new one and the testicle ; or the newly protruded sac may descend before the vaginal covering of the testicle, and carrying down with it the old sac, the latter may become situated between the new sac and the vaginal coat of the testicle. This appears to me to be the case in two preparations in the rich collection of ruptures at St. Bartholomew's Museum ; and these cases are further interesting, as both also have hydrocele of the vaginal coat of the testicle itself.

(*a*) SCARPA, Sull' Ernie, Memorie Anatomico-chirurgiche. Milan, 1809. fol.—IB., A Treatise, on Hernia, translated ; with Notes by WISHART. Edinburgh, 1814. 8vo. p. 97.

Sometimes a rupture is accompanied with a common hydrocele below it; but in more rare cases the hydrocele is in front of the rupture, and generally is not discovered till the operation is performed, when it is liable to produce confusion, and make the operator suppose he has mistaken the case.

Thomas Blizard appears to have been the first person who observed hydrocele in front of an inguinal rupture. His patient had been subject to bubonocele on the right side upwards of six years, and he had almost constantly worn a truss. During the last two years of this period, a swelling of the testicle on the same side, which seems to have been hydrocele, occurred, but after a few months disappeared, and left the testicle wasted and drawn up to the groin. " When first called to him," says Blizard (*a*), " I found a small bubonocele on the right side, and could distinctly feel the *testis* of the same side, but very small, lying at the bottom of the *hernia*, having an inclination forwards. * * * Twenty hours after the descent I performed the operation. Having dissected down to a membrane, which I considered to be the hernial sac, I punctured it at the upper part, and then laid it open its whole length. It extended within the ring, which to obtain room for examination, I dilated. Upon further inquiry, I found the *hernia* was situated more deeply, and that the membrane which I had laid open was the *tunica vaginalis testis*, extended by the hydrocele, which had entirely disappeared. I then of course dissected through this *tunica vaginalis* at the posterior part, and laid open the hernial sac, which contained a portion of intestine nearly black from strangulation." The stricture was at the mouth of the sac. " In this case the *hernia* must have been behind the cord." (p. 66.)

Another example of this kind occurred to the younger Cline shortly after, and is mentioned by Astley Cooper (*b*). I witnessed this operation. " On making an incision. into that which was supposed to be the hernial sac, a fluid similar to that of hydrocele escaped, which it afterwards proved to be, for it was the *tunica vaginalis* which had been opened ; on dilating this opening a little, a tumour presented itself, which was afterwards found to be from $\frac{1}{8}$th to $\frac{1}{4}$th of an inch thick, which, being dissected through, a fluid resembling the first in colour, but of a fetid smell, came out. This tumour was found to be the *tunica vaginalis* of the cord, but much altered from the natural appearance by a quantity of lymph that had been effused, which gave it the appearance of India rubber ; the intestine had adhered firmly to the adjacent parts, and the stricture was divided with (on) the finger. Mr. Cline thought it not advisable to attempt to break through the adhesions, so as to return the intestine, lest it might bring on a dangerous degree of inflammation." (p. 17.) He did well. These cases are not so uncommon as formerly supposed, and many of our Museums in London possess two or more examples.—J. F. S.]

1200. *Varicocele*, when it has attained considerable size, has indeed some resemblance to omental rupture, the abdominal ring is not, however, stretched ; the several strings of the swollen vessels are felt ; if the swelling be compressed for a few moments between the fingers, without thrusting it back towards the belly, it almost entirely disappears ; the whole mass of the testicle seems expanded into varicose vessels. In doubtful cases, let the patient be laid on his back, return the swelling, and press with the finger on the abdominal ring ; this pressure will, when he rises, be sufficient to prevent the protrusion of the intestine, but not to suppress the flow of blood into the spermatic vessels.

1201. If an inflammatory swelling of the spermatic cord be developed spontaneously, the *diagnosis* is doubtful, so much the more, if injuries, as violent strains, blows, and the like, which equally cause ruptures, produce this inflammation. Such inflammatory swelling passes through the abdominal ring, descends to the testicle, which seems as it were confused with the swelling ; it is elastic, painful, and manifestly inclosed by the inguinal canal. Fever comes on, the bowels may be drawn in to participate, suppression of their relief, disposition to vomiting and the like are produced. In such cases the *diagnosis* is more difficult, if previously there were a rupture which has become strangulated by the injury which has excited the inflammation of the cord.

(*a*) Astley Cooper, above cited.

(*b*) Above cited.

1202. When the testicle only, at a late period, descends through the inguinal canal, or when, on account of the shortness of the spermatic cord, it remains in the canal, it may by the opposition which the walls of the canal offer it, become inflamed. If in examining the *scrotum*, only one testicle be found, the *diagnosis* is thereby determined. An imperfectly developed external inguinal rupture may exist at the same time with one testicle lying in the groin, the protrusion of which may cause the severest pain, by its pressure on the testicle, as I myself have noticed in one instance.

[(Key (*a*) mentions a case of strangulated inguinal rupture, in which the testicle had never descended lower than the external ring, in consequence of which "the shape of the swelling was peculiar; the *hernia*, instead of passing downward into the *scrotum*, turned, after emerging from the inguinal canal, over the tendon of the external oblique muscle, and appeared somewhat like a femoral *hernia*." (p. 25.)

There is also an example of this kind in the Museum of the Royal College of Surgeons; and at St. Bartholomew's there is an instance of a congenital rupture in the inguinal canal, in which the testicle also is still remaining.—J. F. S.]

1203. Fat may be collected in the cellular tissue of the spermatic cord, project from the abdominal ring, or may exist along the cord in the *scrotum*, and form a swelling, which otherwise is accompanied with scarcely any inconvenience. But a collection of fat may arise upon the front or hind surface of the *peritoneum;* in this enlargement the fat descends through the abdominal ring into the *scrotum*, and drags the *peritoneum* with it. These so-called *Fat-Ruptures*, which may be formed on different parts of the belly, have the greatest resemblance to omental ruptures, especially if they, as is frequently the case, can be reduced.

Collections of fat upon the surface of the *peritoneum* may protrude through the white line, through the interspaces of the muscles, or through the natural apertures of the belly. If these swellings be situated at or upon the white line, they rarely attain any considerable size; usually their size is from that of a nut to that of an egg. Some fatty granules, deposited on the outer surface of the *peritoneum*, are gradually received into one of the little openings or clefts formed by the fibres of the tendinous *aponeurosis*, where they by degrees grow and enlarge, become converted into a swelling with a neck, the root of which is attached to the *peritoneum*, the neck surrounded by the fibres of the *aponeurosis*, and the bottom spread beneath the skin. They are usually firmer when small, and penetrating through a small opening; on the contrary, of looser texture when large, and increasing without restraint. Often they seem to be reduced and got rid of, but often they are immovable. The continual dragging to which they are subject not unfrequently produces a funnel-shaped projection of the *peritoneum* at that part where they arise, and thus they present a sac-like extension, surrounded by a fatty swelling, which, according to Velpeau, may cause a real rupture; this danger, however, Pelletan states, does not happen when a considerable quantity of fat is found around the soft swelling, for the purpose of preventing the entrance of intestine or *omentum* into this elevation of the *peritoneum*. These swellings are frequently surrounded with membranes which present perfect coats, and sometimes also contain cysts. The fatty ruptures usually produce neither pain nor other inconvenience, and often remain unobserved throughout the whole life; but if they lengthen deeply into the duplicature of the sickle-shaped ligament of the liver, they may produce great inconvenience, by actually tearing the liver and the *peritoneum* in the movements of the abdominal muscles. Fat-ruptures cannot with certainty be distinguished from omental ruptures, for if, as Scarpa affirms, they be usually tougher and less compressible, this character, however, loses all value in old and adherent omental rupture. Pelletan first pointed out the mechanism of the fat-rupture, when it descends through the inguinal canal. In three cases he found the fatty mass doubly enveloped in *peritoneum*, when the fatty swelling was attached entirely to the *peritoneum*, like the testicle in its descent; and in the protrusion of the fatty swelling into the *scrotum*, the *peritoneum* was drawn over it like a sheath. The fatty swelling in the *scrotum* has the same relations as the testicle

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(*a*) Memoir.

in its vaginal tunic, being doubly covered by the *peritoneum*, to the one part of which it is firmly and to the other loosely attached. This sometimes also occurs when the fat-rupture passes out by any other of the natural openings in the belly. Although, however, fat ruptures be found in the *scrotum* without any peritoneal covering, the *peritoneum* is more or less withdrawn or not at all connected with them, if they be merely collections of fat in the cellular tissue of the spermatic cord. Although the cavities formed by the double lengthening of the *peritoneum* do not close, but communicate with the cavity of the belly, as does the cavity of the vaginal tunic in congenital rupture, yet the fatty mass usually fills the sac so completely, that very rarely does intestine of *omentum* descend with it and complicate the case. The distinction of this fat-rupture from true rupture is often very difficult. Its gradual growth, and its freedom from pain on pressure, even when very considerable, are characteristic symptoms; but their resemblance to omental ruptures has even deceived the most experienced practitioners. If severe colic or the like accompany such swelling, a mistake is the more easy, and is only first discovered in the operation (SCARPA, CRUVELHIER, OLLIVIER.)

Compare also on this subject MORGAGNI, De sedibus et causis Morborum, Epist. xlv. art. 10. Epist. l. art. 34.

PELLETAN, Clinique chirurgicale, vol. iii. p. 33.

BIGOT, Dissert. sur les tumeurs graisseuses extérieuses au péritoine, qui peuvent simuler des Hernies. Paris, 1821.

COATES, B.; in Cyclopædia of Pract. Medicine and Surgery, edited by ISAAC HAYS. Philadelphia, 1832.

1204. Collections of pus which pass along the spermatic cord, out at the abdominal ring, may diminish or disappear in the supine posture, and increase on coughing and any other exertion; the fluctuation, the presence of symptoms of *psoas* abscess or of *caries* of the vertebral column may, however, guide the practitioner.

1205. Inguinal ruptures must be returned in the same direction by which they have protruded, that is, the external or oblique from below upwards, and from within outwards; and the internal or direct, from below upwards and directly from before backwards.

1206. For the purpose of keeping the rupture up, a truss with a semicircular spring which closely surrounds one half of the *pelvis* is best. In the external or oblique inguinal rupture with a long neck, the pad must press upon the whole length of the inguinal canal; but in internal or direct rupture it must merely press on the external inguinal ring in the direction from before backwards. For the external inguinal rupture with a short neck the truss should be the same.

1207. The strangulation of inguinal rupture may be situated at the external or internal inguinal ring, in the neck of the sac, or in strictures of the body of the sac. If it cannot be removed by the general treatment above mentioned, the operation must be performed with the following special objects:—

1208. The cut through the integuments should always be made, especially in large ruptures, in the mesial line of the swelling, on account of the possible displacement of the spermatic cord, and carefully, because there may be a rupture without a sac (1). In every very large external or oblique rupture the cut should be commenced above the abdominal ring, where the swelling is narrowest, and not further continued till it has been ascertained, by feeling with the finger, whether the spermatic cord do or do not lie upon the hernial sac. When there is much water in the sac, the opening may be made boldly. In addition to the signs already mentioned, (*par.* 1170,) of having laid bare the hernial sac, this circumstance still serves, that as the hernial sac is always connected with the pillars of the abdominal ring, the ring cannot be penetrated before the opening of the sac with the point of the forefinger. If the hernial sac be thin, it can be torn, by seizing it with the forceps; but if it be very thick, frequently a superficial layer only must be divided, by which it is rendered more transparent and rather bluish. In dividing the stricturing part, in well determined external or oblique inguinal rupture, the cut must be made *outwards*, towards the iliac spine, but in the internal or direct inguinal rupture, *upwards and inwards*; in those cases where it is doubtful of which kind the rupture is, *directly upwards*, parallel with the white line, so that the cut may form a right angle with the body of the share-bone. After the complete return of the intestine, the forefinger should be carried through the inguinal canal, into the belly, to ascertain that it is clear and that no portion of intestine remain in it. In imperfectly developed external inguinal rupture, if the strangulation be at the internal ring, the skin, the superficial *fascia* and the tendon of the external oblique muscle must be divided in the direction of the inguinal canal, outwards and upwards, and the seat of stricture cut into *outwards and upwards*.

(1) On account of the circumstances already mentioned, (*par.* 1192,) it is always of importance before operating on an old scrotal rupture on the right side, to consider whether the rupture be formed by the *cæcum* or the beginning of the *colon*. Besides the size and long continuance of the swelling, its knotty condition excites suspicion, which is probable, if the rupture have been slowly produced. So long as it was in the groin it was returnable, but no longer; at least it cannot be perfectly returned so soon as it has descended into the *scrotum*, when the patient, after digestion is ended, and a short time before the bowels are relieved, feels dragging and pressure in the rupture, as well as frequently colicky pains, which subside after going to stool, and if there be in the right iliac region a hollow corresponding to the size of the rupture. In this rupture the stricture only is to be divided, and the adherent intestine covered with compresses, dipped in a mucilaginous fluid, by which in general it gradually returns into the belly.

The various opinions upon the most proper direction for the cut into the stricture, in inguinal rupture, in order to avoid injuring the epigastric artery, have only by the correct anatomical knowledge of its different origin, attained the proper explanation. The direction of the cut obliquely *upwards and outwards*, as proposed by LOUIS, MORAND, SHARP, GUNZ, POTT, BELL, SABATIER, and others, is so far the most proper, as in external or oblique inguinal rupture the artery cannot be injured, and it is by far the most common. (*par.* 1194.) As in the direction of the cut obliquely *upwards and inwards* towards the navel, according to HEISTER, GARENGEOT, LE DRAN, RICHTER, MOHRENHEIM, MURSINNA, and others; or *inwards towards the symphysis*, after LUDWIG and SEILER, only in internal or direct inguinal rupture can the artery be avoided, but in external rupture it can and must be wounded, if it be not granted that thereby really only the internal pillar of the external inguinal ring shall be cut into. The direction of the incision *directly upwards*, proposed by FRANCO, DIONIS, PETIT, CAMPER, ROUGEMONT, and others, was for that occasion the safest, and ASTLEY COOPER (above cited,) still considers it the most proper and safe in all cases. CHOPART and DESAULT gave the most important advice, always to make the cut *towards the side opposite the position of the spermatic cord*, advice, which the knowledge of the corresponding relative position of the spermatic cord and spermatic artery, and a presumption of the various kinds of inguinal ruptures, renders clear (2).

[(2) I do not think CHOPART and DESAULT's counsel is the best that can be taken, if it mean anything more than a caution not to divide the spermatic vessels, which no one would do but by the most gross carelessness. Practically speaking, however, I can say that I do not recollect having had or seen a single instance of operation interfered with by the position of the spermatic vessels, presuming that no pupil of CLINE or COOPER would think of dividing the stricture in strangulated inguinal rupture in any other direction than directly upwards, and neither to the right hand nor to the left. For whatever may be said, it is impossible, I believe, to distinguish, without actual dissection, whether an inguinal rupture be oblique or direct, and therefore any deviation from the directly upward division is hazardous.—J. F. S.]

1209. *Congenital* inguinal rupture, in regard to its treatment, agrees

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(*a*) Memoir.

entirely with that of external or oblique rupture. The radical cure here takes place earlier, by the constant use of a truss, as the canal of the vaginal tunic has a natural disposition to close; on which account strangulation mostly occurs from a stricture of this canal. The sac is often so contracted, even at its lower end, that the cavity of the vaginal tunic is entirely closed from the rest of the hernial sac. If a portion of intestine protrude with the testicle, it must be attempted carefully to draw down the testicle into the purse, and to keep up the rupture by the truss; if the testicle remain at or in the external inguinal ring and will not descend, a truss, with a concave pad, must be carefully applied. Pressing back the testicle, recommended by many persons, is very painful and dangerous, as degeneration of the testicle may be caused by the pressure of the truss. If the rupture adhere to the testicle, and keeping up the former be very painful, an operation and division of the adhesion is indicated. If strangulation be present and the operation necessary, (which even in the first days after birth may happen,) it must be performed with particular caution, that the testicle be taken care of. Any adhesion between the testicle and the protruded parts must be divided. If water as well as intestine be contained in the congenital rupture, it can be determined, after having returned it with the intestine, and putting the finger on the ring by raising the patient, when the water first, and then by coughing or the like, the intestine protrudes. If in these cases a truss be applied, in most, the water is gradually absorbed.

1210. After completing the operation for inguinal rupture, and cleansing the wound, the edges of the skin should be brought together, with some interrupted stitches, and between them strips of plaster applied, and covered with wadding; to the region of the inguinal canal a many-folded triangular compress is to be applied and kept in place with a T bandage. The patient should lie in bed on his back, with his thighs drawn up towards the belly, and supported by a bolster beneath the knees. The after-treatment is to be conducted by the rules already laid down.

1211. In the operation for inguinal rupture, *without opening the hernial sac*, after making the proper cut of the skin a small aperture is to be made in the tendon of the external oblique muscle, a little above the external inguinal ring, and a director introduced, with which it is sought to find the seat of stricture, and then it should be directed towards the outer or inner inguinal ring and the stricture divided with a knife introduced upon the director (KEY); or the hernial sac is to be drawn a little down, whilst the muscles are raised by an assistant, and then the stricture being rendered visible in the opening of the tendon, should be divided (A. COOPER.)

1212. External inguinal rupture may originate, in women, in the lengthening of the *peritoneum*, which sometimes accompanies the round ligament of the womb, and is comparable to *congenital* rupture in the male sex.

[This lengthening of the *peritoneum* was first described by NUCK (*a*) who called it a *diverticulum*, and said it was about half an inch long and not constant. CLOQUET (*b*) speaks of it by the name of NUCK's canal, as "a cylindrical tube terminating in a point or in a rounded *cul-de-sac*, of which the length and size varies; sometimes, on the contrary, it is a little flask with a narrow neck which communicates with the belly," and that he has "found them not only in female *fœtus*, but also in young girls and women of all ages." (p. 41.)

As to the frequency of congenital rupture in the female, ALLAN BURNS says (*c*) that he has seen seven cases, in six of which he "found the anterior side of the inguinal

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(*a*) Adenographia curiosa, cap. x. de peritonæi diverticulis novis.

(*b*) Recherches Anatomiques.

(*c*) MONRO, A., Jun., M.D., Morbid Anatomy of the Human Gullet, Stomach, and Intestines. Edinburgh, 1811. 8vo.

canal deficient. * * * In one of the subjects with congenital *hernia* the sac did not escape from the canal; in five it had, from the peculiar state of the canal, descended along the thigh, assuming to a great degree the resemblance to crural *hernia.* * * * In congenital inguinal *hernia* the risk is that we must take the disease for crural *hernia.*" (pp. 514, 15.)]

II.—OF FEMORAL RUPTURE.

(*Hernia cruralis, femoralis,* Lat.; *Schenkelbruch,* Germ.; *Merocèle, Hernie crurale,* Fr.)

Vrolyk, G., Arbeelding der vatern, welke in de operatie der dye-breuk by mannen behoven vermyd te worden. Amsterdam, 1800. 8vo. Translated into German as Abbildungen, welche man in der Operation eines männlichen Schenkelbruches zu schonen hat. Amsterdam, 1801. 4to.

Monro, A., Observations on Crural Hernia. Edinburgh, 1803.

Hey, W., Practical Observations in Surgery. London, 1803. Chapter III.

Cooper, A., Anatomy and Surgical Treatment of Crural and Umbilical Hernia.

Burns, A., Observations on the structure of the parts concerned in Crural Hernia; in Edinburgh Medical and Surgical Journal, vol. ii. p. 265.

de Gimbernat, A., Nuevo Metodo de Opera en la Hernia Crural. Madrid, 1793. 4to. Also translated as A new Method of Operating for the Femoral Hernia, by Dr. Beddoes. London, 1795. 8vo.

Hull, Ueber den Schenkelbruch in von Siebold's Chiron., vol. ii. pt. i.

Breschet, Considérations anatomiques et pathologiques sur la Hernie fémorale, ou Merocèle. Paris, 1819.

Liston, Robert, Memoir on the formation and connections of the crural arch, and other parts concerned in Inguinal and Crural Hernia. Edinburgh, 1819. 4to.

Langenbeck, Anatomische Untersuchung der Gegend, wo die Schenkelbrüche enstehen; in his Neue Bibliothek, vol. ii. pt. i.

Schreger, Chirugische Versuche, vol. i. p. 171.

Scarpa, Antonio, Sull' Ernie, Mem. Anatomico-chirurgiche. Ediz. nuova, 1819. The new articles translated into French by Ollivier under the title Supplément au Traité pratique des Hernies, &c. Paris, 1823. 8vo.

Walther, W., Commentatio anatomico-chirurgica de hernia crurali. Lipsiæ, 1820.

Manec, Recherches sur la Hernie crurale. Paris, 1826.

The writings of Scarpa, Hesselbach, Cloquet, and Langenbeck, already quoted.

1213. *Femoral Rupture* passes through the *femoral ring,* (*annulus cruralis,*) usually on the inner side of the femoral vessels, (*internal Femoral Rupture*); in rare cases on the outer side (*external Femoral Rupture.*)

The division of femoral rupture, into *external* and *internal,* is grounded on the observations of Cloquet (*a*), and Hesselbach (*b*), and is proved in opposition to the doubts of Boyer, Lawrence, Langenbeck, and others.

Logier (*c*) describes a new kind of rupture, which passes obliquely through Gimbernat's ligament, and the mouth of which is separated by a portion of that ligament, and by the umbilical artery from the femoral ring. The epigastric and obturator arteries originate from a common trunk.

1214. Poupart's *ligament* stretches like a cord from the upper front iliac spine, to the pubic *symphysis,* where it is fixed, as already described (*par.* 1186.) Just as this ligament approaches the share-bone, it increases in breadth, so that by this broader portion, it is attached along the spine of that bone. This insertion runs inwards to a point; outwardly it is broader, and bounded by an edge, concave towards the femoral vessels, (Gimbernat's *ligament.*) The space beneath Poupart's ligament outwardly, namely, the hollow between the upper and lower front iliac spines, and the ilio-pectinean eminence is filled up by the *m. iliacus*

(*a*) Above cited, p. 85.

(*b*) Der äussere Schenkelbruch; in Neue Chiron., vol. i. p. 91.

(*c*) Archives Générales de Médecine, May, 1833.

internus, and *m. psoas magnus*, so that only in the middle of Poupart's ligament, between the ilio-pectinean eminence, and the sharp edge of Gimbernat's ligament, there remains an oblong opening, the *femoral ring*, (*annulus cruralis*, Lat.; *Schenkelring*, Germ.; *anneau crurale*, Fr., the *inner aperture for the femoral vessels* of Hesselbach,) which contains the femoral vessels, nerves, and lymphatic ganglions. The *m. iliacus internus*, and *psoas magnus*, are covered with a thin *aponeurosis*, (*fascia iliaca*,) which arises imperceptibly from the surface of the former, and lies immediately upon those muscles; the iliac vessels, and *peritoneum*, lie upon and are connected with it by loose cellular tissue. This *aponeurosis* is attached to the *linea innominata*, to the inner edge of the iliac pit, and to the hind edge of Poupart's ligament. Opposite the latter insertion, it terminates running into a point near the passage for the femoral vein. Another portion of this *aponeurosis* passes over the share-bone, behind the femoral artery and vein, towards the thigh, where it forms the hind part of the sheath in which the femoral vessels are enclosed, and is fixed to the *fascia lata*. From this state of parts, the protrusion of the intestines is very difficult; however, the part between the inner concave edge of Poupart's ligament, and the femoral vein, is not entirely closed, but only filled up by a lymphatic ganglion, or by thick cellular tissue. This space is bounded above and before by Poupart's ligament; below and behind by the share-bone; inwardly by the concave edge of Poupart's ligament; and outwardly by the femoral vein. The thigh sheath (*fascia lata*) has two distinct insertions at the front upper part of the thigh; it is firmly attached to the upper part of the share-bone, above the origin of the *m. pectineus*, which it overspreads, and further to the front part of the femoral ring. The former portion proceeds with the iliac *fascia* behind the femoral vessels; the second attaches itself to Poupart's ligament, though not throughout its whole length, for its insertion terminates at the inside of the femoral vessels, which it covers externally. In this region then the femoral vessels lie between the two layers of the *fascia lata*; the upper layer is connected below with the under, by which one opening is formed (the *external opening for the femoral vessels* of Hesselbach; the *oval cavity* of Lawrence, which, at the outer edge, presents a *semilunar edge*; the *femoral ligament* of Hey; the *falciform process* of Burns.) In this outer hole the *vena saphena* passes. This aperture is larger in women than in men where it is entirely closed by a tendinous bundle of net-like tissue. Besides this aperture, there are still several little openings in the upper layer for the passage of vessels. A thick cellular tissue, or a thin *aponeurosis*, spreads over the *fascia*, and covers the *vena saphena*.

[This description of the parts concerned in femoral rupture does not accord with that usually received in England, nor is it correct according to our dissection.

It is a curious circumstance that the tendinous and cellular parts connected with femoral rupture seem to be a general repetition of those of inguinal; in both an aperture exists in the tendinous expansion over the parts, and in both a cellular funnel, less or more perfectly shut up and guarded by *peritoneum*, exists.

Poupart's ligament, or the lower margin of the tendon of the external oblique abdominal muscle, has been already mentioned as stretching from the upper front spine of the hip-bone to the spine and *symphysis* of the share-bone, its two latter attachments or pillars being separated by the external abdominal ring. But on further examination, it is found that the attachment of this tendon is still more extensive, its connexion with the *pelvis* being continued outwards from the pubic spine about half an inch, and finishing by a half oval concave edge facing outwards, thus forming a triangular tendinous space, known as Gimbernat's ligament, which diminishes by its own breadth the opening from the belly to the thigh, between Poupart's ligament in front and the *pelvis* from the pubic spine to the lower front iliac spine, which is also still further lessened upon the outer side by the conjoined mass of the *m. iliacus internus* and *psoas magnus*, as they pass from the *pelvis* into the thigh, to their insertion in the little *trochanter*. The space then actually left is scarcely more than an inch wide to the inner side of the junction of the hip and share bones, and consequently before and above the inner half of the *acetabulum* or hip-socket and a little to its inner side, and through it the femoral vessels pass. But this aperture, the *crural ring*, has further boundaries. As from Poupart's ligament, or the *crural arch*, as it is often called, is expanded above, the tendinous covering of the belly, below the upper front iliac spines, and of the *m. recti* upwards to the pit of the stomach having in it the external abdominal ring, so from the lower edge of the ligament descends an extensive tendinous expansion which encloses all the muscles of the thigh and is lost about the knee-joint, and commonly called the *fascia lata*. This sheath seems to begin by a sharp angle from the lower edge of Poupart's ligament, where Gimbernat's ligament ends above; as it continues outwards it deepens, assuming a crescent or sickle-like shape, forming the falciform process, till it stretches down the whole length of the thigh. But before doing this, and at the distance of about an inch and a half from Poupart's ligament, corresponding also to the same distance from the oblique crease in the skin, which separates the belly from the thigh, it curves suddenly inwards and upwards, spreading as it rises in front of the *m. pectineus*, above the origin of which it is fixed into the *pelvis* as far as the pubic spine. A large opening of an irregular oval form is thus left in the otherwise complete tendinous sheath of the muscles of the thigh. and to it is given by Lawrence the name of *lower or anterior opening of the crural canal;* over the inner lower edge of which the great saphenous vein is seen mounting to enter the inside of the femoral vein, which with the great artery it accompanies, are here uncovered by tendinous sheath, but still covered in a peculiar manner.

It will be recollected that when speaking of the transversal *fascia* in the description of the parts of inguinal rupture, that its lower part at the bottom of the belly was mentioned as consisting of two portions, the front and outer or iliac portion continued along the margin of Poupart's ligament to the upper iliac spine, forming the outer half of the internal abdominal ring, then bending round behind the *peritoneum* and spreading over the front of the *m. iliacus internus* and *psoas magnus*, as they fill the ventral cavity of the hip-bone, and there assuming specially the name *fascia iliaca*. The hinder inner, or pubic portion of the transversal *fascia* was also mentioned as forming the back of the inguinal canal, and the inner half of the internal abdominal ring and then stretching away outwards in a sharp edge up to the spine of the hip-bone, behind the front portion, there terminated, and might with equal propriety be called *fascia pudica*, it being remembered, however, that neither it nor the so-called *fascia iliaca* are other than continuations or processes of the transversal *fascia*. In the angular track between Poupart's ligament in front, and the *m. iliacus* and *psoas magnus* behind and on the outer side, and the edge of Gimbernat's ligament and the angle of the share-bone, behind and on the inner side, these the iliac and pudic portions of the transversal *fascia* unite in a kind of seam on each side, but separated in the middle at the gap formed by the crural arch for the passage of the femoral vessels. Thus far completes the description of the transversal *fascia* in the belly; part of which only, namely, that immediately connected with inguinal ruptures, had been described. It remains now to speak of this *fascia* as connected with femoral rupture.

The aperture behind Poupart's ligament, or the crural arch, and called by Hey the *femoral ring*, gives passage to the femoral vessels, which, whilst in the *pelvis*, lie upon the iliac portion of the transversal *fascia*, between it and the *peritoneum*, but reaching the crural ring, escape from behind the *peritoneum*, and then are placed between the just-mentioned iliac portion of the transversal *fascia* behind, and its pudic portion in front. Here the iliac and pudic *fasciæ*, having joined so as to form a corresponding opening to the femoral ring, are continued down into the thigh, in the shape of a wide, but much flattened funnel, behind the *fascia lata*, but uncovered by it, as the funnel descends behind its oval opening, and containing within it the femoral vessels, is called the *femoral sheath*, the hinder or iliac portion of which descends only to the origin of the deep branch of the femoral artery; whilst its front, or pubic portion, extends along the trunks of the femoral vessels till they penetrate the tendon of the *m. triceps adductor femoris*. A process passes from the front to the back of the sheath, along its whole length, dividing it into two distinct canals, in the outer of which is contained the femoral artery, and in the inner the femoral vein. Immediately above the lower edge of the oval opening of the *fascia lata* is an opening on the inside of the femoral sheath, through which the great saphenous vein penetrates to empty itself into the femoral vein. Above the former, the absorbent vessels penetrate, as Astley Cooper (*a*) describes, "through the inner side of the sheath, near the *pubes*. In the male subject I have seen them enter the sheath in a cluster, through a single hole in this *fascia* ; but in both sexes the *fascia* is generally rendered cribriform, by these vessels passing through a variety of small openings." (p. 9.) He also further states, what I must confess I have never observed, that "if the sheath be opened, the contents will be found separated by *two* membranous *septa*, one passing between the artery and vein, and the second, equally distinct between the vein and the absorbents. * * * The contents of the sheath differ in their attachments to the bag; the artery and vein are seen completely filling up the space in the sheath which is allotted to them; while the absorbents are loosely connected by means of cellular membrane and fat, which, not affording sufficient resistance to the pressure of the abdominal *viscera*, occasionally allows the descent of a *hernia*." (p. 10.) This portion of the sheath is commonly, in health, called the cribriform *fascia*, and it is between it and the femoral vein that femoral rupture first enters the sheath, and then, protruding its inner side, has been called by Astley Cooper the *fascia propria* of the rupture, a most inappropriate name, as it might lead to the supposition of a new formation instead of the simple protrusion of an old structure in these cases. In regard to this covering of the femoral sac, Cooper says:—"A thin *fascia* naturally covers the opening through which the *hernia* passes and descends on the posterior part of the *pubes*. When the *hernia*, therefore, enters the sheath, it pushes this *fascia* before it, so that the sac may be perfectly drawn from its inner side, and the *fascia* which covers it left distinct. The *fascia* which forms the crural sheath, and in which are placed the hole or holes for the absorbent vessels, is also protruded forwards, and is united with the other, so that the two become thus consolidated into one." (part ii .p. 2.) Cloquet also describes the closure of the top crural sheath in a very similar manner. "The upper orifice of the crural canal (sheath) is closed," says he, "by a membranous partition, which opposes the formation of crural rupture, as well as the entrance of the finger when pushed from above downwards, above the crural arch. This partition forms above the arch a sort of diaphragm-cellulo-fibrous, whitish, thick, and very resistant in some subjects; simply cellular, weak, and readily yielding in others. I propose giving it the name *crural septum*. It arises completely around the upper opening of the crural canal, is thickish, and its fibres are most commonly transverse in front, towards the crural arch. Within it proceeds from the cellular tissue behind Gimbernat's ligament; or, rather, from the concave edge of that ligament itself, conjointly with the inner wall of the crural canal (sheath) itself. Externally it is blended with the femoral sheath, and the laminar tissue encircling the epigastric artery, on the outside of which cellular tissue fills the space between the crural arch and vessels. Its upper abdominal surface is concave; its lower, towards the crural canal concave; but sometimes both surfaces are flat. It always presents one or more apertures for the passage of the lymphatic vessels, and sometimes the upper part of the crural canal seems merely closed by a fibro-cellular network. One of these openings, larger than the others, is central, and penetrated by an oblong lymphatic gland, and will admit the finger." (pp. 73, 4.) Lawrence says that he has not found, on dissection, either Cooper's "thin *fascia*," or Cloquet's "membranous partition," and is "disposed to refer the origin of this *fascia propria* to the condensed fibrous substance, which completes the crural sheath on its inner or mesial side." (p. 478.) And with his views in this respect I fully concur. —J. F. S.]

1215. Although the femoral ring is a larger opening than the abdominal, yet femoral is more rare than inguinal rupture, because the intestines do not press so directly upon this part; it is not originally open, nor does any organ descend through it. Femoral rupture is more frequent in women than in men.

1216. Femoral rupture commences with a little roundish deep-seated swelling beneath Poupart's ligament, which as it enlarges spreads aside, so that its base increases in breadth, and its greatest diameter corresponds to the oblique direction of the groin (1). The swelling never attains the size of inguinal rupture; it may, however, spread over the femoral vessels and nerves, and produce a sensation of numbness, or œdematous swelling of the foot of the affected side. In men, the distinction between femoral and

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(*a*) Hernia, part i.

inguinal rupture is easy, because the latter closely follows the direction of the spermatic cord; but in women it is more difficult, because the cord does not exist, and the abdominal is nearer the femoral ring (2). Femoral rupture is easily distinguished from a bubo, and from a collection of pus; the *diagnosis* is, however, more difficult when the rupture is accompanied with a swelling of the glands (3).

[(1) Femoral rupture commonly after descending a little down and protruding the sheath inwards, turns upwards upon POUPART's ligament, so that the bottom of the sac is above the mouth. ASTLEY COOPER, however, states that "it sometimes happens that instead of crossing the thigh in the direction of the crural arch, it extends downwards along the edge of the crural vein and the *vena saphæna major*. (p. 1.) The tumour does not quit the sheath for the crural vessels. The appearance of this disease is that of a general swelling of the *fascia* on the inner side of the femoral vein, but without its producing any circumscribed tumour. The part swells whenever the patient coughs or uses any considerable exertion, but the swelling diminishes though it does not entirely subside, when he stands at rest. * * * I believe it to be not an unfrequent variety, as I have met with it three times in the dead body, and it existed on both sides in each. * * * It is continued downwards within the sheath, passing anteriorly to the femoral vein, and descends as far below the crural arch as the sheath will allow, the distance being in general from two to three inches." (p. 25.) CALLAWAY tells me one such case occurred under his care, and was at first supposed to be *varix* of the femoral vein, its true nature was, however, discovered, and a truss was applied with advantage.

(2) In ordinary cases I have never seen any difficulty of distinguishing femoral from inguinal rupture in women; and cannot conceive it possible, except whilst the latter is in the inguinal canal, or on the point of passing through the external abdominal ring; but even then it is not difficult to determine, as the swelling of femoral rupture can be pushed down into the thigh, and POUPART's ligament either thereby exposed or the fingers passed between the rupture and it, which cannot be done by pressing down inguinal rupture, as thereby POUPART's ligament is more hidden.

(3) Besides those here mentioned, there are other swellings in the upper part of the thigh or groin liable to be mistaken for femoral rupture. ASTLEY COOPER mentions an enlargement of the crural vein, which dilated when the patient coughed, (in consequence of the return of blood into the belly, made by the pressure of the bowels upon the iliac veins,) disappeared in the recumbent, and reappeared in the erect posture. * * * It was easy to detect the nature of the case, for although it disappeared in the recumbent posture, it was immediately reproduced, although he continued in that posture, by pressing on the vein above the crural arch, and retarding the return of blood." (p. 4.) Tumours also, either fatty or encysted, may occupy the seat of the rupture, and be mistaken for it. Of the latter there is an example in St. Thomas's Museum.—J. F. S.]

1217. The coverings of femoral rupture are, *first* the external skin; *second*, cellular tissue and glands; the layer of the former is often very thick and loaded with fat; *third*, the superficial layer of the *fascia lata* (1); and *fourth*, the hernial sac, the protruded part of the *peritoneum*, which is covered on its surface with a layer of loose cellular tissue.

These coverings are not the same in all cases; a rupture of increasing size may protrude through the aperture by which the *vena saphena* has entered, so that it is then for the most part covered only with skin and subjacent cellular tissue. Most commonly a portion of the *ileum* is included in femoral rupture, more rarely the *omentum*, and extremely seldom a portion of the bladder.

[(1) This is erroneous; the *fascia lata* never covers femoral rupture, which passes, as already mentioned, through the oval opening, and the third covering is the protruded *sheath of the femoral vessels*, as I have already described.

I recollect seeing GREEN operate on a case in which, when the so-called *fascia propria* was exposed, it had a nodulated form, and gave some idea of intestine covered only with its peritoneal sac; but on carefully cutting through, a mass of soft fat was found beneath it, under which was the sac.

In another case under my own care, having cut through the *fascia propria*, as seemed, I thought I had reached the peritoneal sac, and dividing it, as mall quantity of fluid was discharged, which led me to suppose I had opened the sac, but what I supposed to be intestine remained very immovable, and led me to doubt. Upon examining what was thought to be mesentery I found the vessels running in all directions, and the part itself semitransparent; I therefore carefully cut through it, and immediately about a tablespoonful of fluid escaped, and a knuckle of intestine was exposed.—J. F. S.

A very remarkable case of femoral rupture is mentioned by Berard (*a*), which contained the Fallopian tube, and a large quantity of fluid. It had commenced two years previously in a small tumour, which was reducible, but she neglected wearing any bandage. In December, 1837, the growth had become more rapid, and the swelling, which was in the right groin, larger than a hen's egg, stretched somewhat towards the *abdomen* and right *labium*, with a broad base, and smooth surface, except on the upper inner side, where a nipple-like process, as big as the top of the finger protruded, and the skin covering it was thin and bluish. The tumour fluctuated, and was transparent, and she says returns into the belly when she lies down. It was presumed to be a serous cyst developed in the part, or an old hernial sac closed by adhesion at the neck, and become dropsical. She had also a hard round body, as big as a turkey's egg, protruding above the *pubes*, which, on examination, by the *vagina* was found to originate from the womb. The first-mentioned swelling was punctured with a trocar, and six or eight ounces of citron-coloured frothy *serum* discharged, which coagulated with heat. A round body, as large as a small nut, and irreducible, was felt in the femoral ring, and ceased to be felt behind the crural arch. On the fifth day after the operation the sac suppurated, and she died on the seventh. On *examination* the interior of this cavity was found lined with albuminous exudation, and it communicated by a free opening with the peritoneal cavity behind Poupart's ligament. It contained nothing but the Fallopian tube in a state of considerable hypertrophy, without adhesion to the interior of the sac, but closely united to the anterior part of the circumference of the sac. The tissue of the womb was healthy, except being distended by an enormous fibrous tumour.]

1218. The epigastric artery is on the outer side in internal femoral rupture, and ascends on the outer side of the hernial sac, where it crosses the spermatic cord, which runs on the upper and inner side of the rupture. The variations in the course of the epigastric and obturator arteries are here of the greatest importance. If the obturator artery arise from the external iliac or from the epigastric, or both from the crural artery, when it has passed below Poupart's ligament, the obturator artery runs along the inside of the hernial sac, down into the *pelvis*. In the same direction, frequently passes a not inconsiderable branch of communication from the epigastric to the obturator artery. The observations on the frequency of these different origins do not always precisely agree; the origin of the obturator artery is, however, almost more common from the epigastric, than from the internal iliac artery (*b*).

1219. The spermatic cord surrounds the upper part of the neck of the hernial sac, describing a semicircle inwards, so that the neck of a femoral rupture lies between the epigastric artery and the spermatic cord, at an equal distance from both.

1220. Femoral rupture is often very difficult of reduction owing to its depth. The *taxis* must, in a small femoral rupture, be applied directly from before backwards; but in a large one, first from above downwards, and then from before backwards, the thigh being also much bent at the groin. The fingers of both hands are to be applied on the swelling, and attempts made gently, but continuously, to return the parts. In order to keep the femoral rupture up, a similar bandage to that used in inguinal rupture is employed, only with a shorter neck, because the femoral ring is

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(*a*) L'Expérience, April, 1839. — British and Foreign Medical Review, vol. x. p. 267.

(*b*) Cloquet, above cited.—Hesselbach, A. K., Ueber den Ursprung und Verlauf der unteren Bruchdecken Schlagader und der Hüftbeinloch Schlagader. Nachtrag zu seiner Schrift: Ueber die sicherste Art des Bruchschnittes in der Leiste. Bamberg und Würzburg, 1819. 4to.; with six Engravings.—Tiedemann, Erklärung seiner Abbildungen der Pulsadern, p. 288–298.

nearer the iliac spine, than to the front inguinal or external abdominal ring. The direction of the neck of the bandage must correspond to that of POUPART's ligament, to wit, from the side towards the share-bone. The edge of the pad must not descend over the bend of the groin.

1221. Femoral rupture may be strangulated in the external or in the internal aperture for the vessels; the strangulation is generally very severe, and if reduction cannot be effected, the operation is soon indicated.

The strangulation may also be situated in the neck of the sac, especially if a truss have been worn for a long time. JAËGER's assertion (*a*) that no case of strangulation by the neck of the sac is known, I must deny. I would add, that in two cases the reduction of the intestine was impossible, although the femoral ring was so considerably cut into that the finger could be readily passed into it, and turned about in every direction. In both cases the strangulation was in the neck of the sac, after the division of which the bowel was easily reduced.

[KEY considers the usual seat of stricture in femoral rupture to be "a tendinous band, which joins the *fascia transversalis* to the posterior margin of POUPART's ligament, and which is quite distinct from GIMBERNAT's ligament, upon which so much stress is laid by some as constituting the stricture." (p. 14, *note*, part ii.)]

1222. The cut through the skin in the operation for femoral rupture should have an oblique direction, corresponding to POUPART's ligament, and should extend half an inch over the swelling towards the iliac spine and the pubic *symphysis*. The cellular tissue is then to be divided as described (*par.* 1170) in the direction of the cut in the skin. The subjacent fat, which in stout persons is often very considerable, has a peculiar consistence, and often a resemblance to a piece of *omentum*, must be carefully separated from the bands, and the upper layer of the *fascia lata* cut through (1); the hernial sac is then to be exposed and opened. A case may occur in which the rupture protrudes through the opening of the upper layer of the *fascia lata*, in which instance, by cutting through the skin and cellular tissue, the operator comes at once upon the hernial sac. The opening of the hernial sac requires the greatest care, as there is always but little fluid, and frequently only a small loop of intestine uncovered by *omentum*.

The oblique cut, corresponding to the great diameter of the swelling, (SCARPA, ZANG, and others,) is in general most suitable, because by dividing the upper layer of the *fascia lata*, POUPART's ligament, is at the same time relaxed. In large swellings, or in stout persons, a T-shaped (COOPER, LAWRENCE, and others) or a transverse incision (PELLETAN, DUPUYTREN) may be made. The directly vertical incision is objectionable.

[(1) It must not be forgotten that what CHELIUS here and elsewhere calls the upper layer of the *fascia lata* is really the femoral sheath.—J. F. S.]

1223. If the strangulation be caused by the outer aperture of the femoral vessels, or by the opening of the external layer of the *fascia lata*, the tendinous edge of this aperture must be carefully cut into. If the strangulation be in the femoral ring, different modes of treatment are proposed.

(*a*.) In women the point of the forefinger or the director should be introduced between the neck of the hernial sac and the intestine, the button-ended bistoury passed upon it, and the inguinal ligament cut into inwards and upwards.

(*b*.) In men the button-ended bistoury should be introduced upon the director which has been passed on the inside, to protect the spermatic cord, and the inguinal ligament should be divided horizontally inwards, or rather a little obliquely upwards, two or three lines deep (SCARPA.)

(*a*) Handwörterbuch der Chirurgie, vol. iii. p. 591.

Dupuytren cuts obliquely from below upwards along the edge of the outer inguinal ligament, in the direction by which the spermatic cord descends.

(*c.*) For the purpose of more surely preventing the injury of the epigastric or obturator artery, Arnaud's hook should be introduced under the inguinal ligament, so as to draw it obliquely up towards the navel, whilst the power of the pull should be kept up by the finger introduced beneath Poupart's ligament, and the intestine pressed back. If the inguinal ligament be not thereby sufficiently stretched, some slight cuts, only a line deep, must be made in its edge, and then it must be raised up with Arnaud's hook (Schreger.) In the same way Le Blanc's dilator is to be used. Also by introducing the forefinger between the inner surface of the hernial sac and the edge of Gimbernat's ligament, the latter may be stretched, or even torn (Rust and others) (*a*).

For an account of the numerous modes of proceeding in the operation for femoral rupture, see

Schreger, Grundriss der chirurgischen Operationen, vol. i. p. 254. Third Edit.

1224. The danger, which, in the above-described course of the obturator and epigastric arteries, is run from the practice *a* and *b*, on account of the injury of these vessels, the favouring of the recurrence of a rupture by the bloodless expansion, according to *c*, further, the circumstance that the parts suffer considerable bruising, and the mere extension in many cases is not sufficient for the removal of the strangulation, have decided Hesselbach to the practice (which in a manner resembles the earlier practice of Bell, Else, and others) of seizing the exposed lower edge of the inguinal ligament with the forceps, and cutting into it layerwise, from below upwards, two lines deep, and to introduce the forefinger between the intestine and the seat of strangulation. If the cut be insufficient, it must be lengthened through the fibres of the *aponeurosis* of the external oblique abdominal muscle above the spermatic cord, which is raised by an assistant, and the inner inguinal ligament should be cut into in the same way (*b*).

1225. This practice, although safer, on account of the deep situation of the femoral ring, especially in stout persons, is accompanied with great difficulty. That proposed by Scarpa and Dupuytren seems preferable to all other, if attention be paid to the following circumstances; the point of the forefinger is to be so introduced between the protruded part and Gimbernat's ligament, so as to bring the nail behind its sharp edge; Cooper's hernia-knife with the probe point, is to be passed upon the finger, behind the sickle-shaped edge of Gimbernat's ligament, so that the edge does not extend above it. The edge is then to be pressed by the front of the finger against the ligament, so as to effect its division by pressure, and not by drawing. A smaller cut of one or two lines' extent is often sufficient for the reduction of the protruded parts, by slightly pressing in with the finger. If this be insufficient, the incision must be repeated (*c*).

[The division of Gimbernat's ligament is useless; the stricture in femoral rupture is almost invariably in the neck of the sac itself, which must be divided, or the rupture will not return.

(*a*) Trüstedt, Ueber die Vorzüge der Ausdehnung vor dem Schnitte bei der Operation des eingeklemmten Schenkelbruches; in Rust's Magazin, vol. iii. p. 227.

(*b*) Hesselbach, A. K., die sicherste Art der Bruchschnittes in der Leiste. Bamberg und Würzburg, 1819.

(*c*) Scarpa, above cited.—Langenbeck, above cited, p. 80.—Richerand, Histoire des Progrès recens de la Chirurgie, p. 62.

In operating on femoral rupture, without opening the sac, KEY observes: — "It may be as well to disturb the subjacent cellular membrane as little as possible, as inflammation is less likely to follow, and to assume the form of erysipelas. For this reason the inverted ⊤ incision, usual in the operation for femoral *hernia*, may be in most cases reduced to a single incision, either at right angles to POUPART's ligament, or in a transverse direction across the tumour. In patients who are spare, and in whom the neck of the sac lies at no great depth from the surface, it is unnecessary to disturb the cellular membrane by turning aside the flaps of the integuments. This will diminish the suppurative inflammation, and in such cases will afford ample room for the operation. I have not made trial of the perpendicular form of incision, but a single transverse one I have found sufficient when the integuments have been loose and the tumour not large. The superficial *fascia* adheres firmly to the common integuments, and is usually turned aside with them, especially when the latter are pinched up for the purpose of making the first incision. The *fascia propria* is therefore quickly exposed, and forms the first distinct covering of the tumour, being darker than the more superficial cellular investment. It is under the outer layer of this *fascia* that the adipose structure is formed, and which often assumes the appearance of *omentum*. The director easily makes its way under this fatty matter as far as the neck of the sac, which lies deeper than the operator at first supposes. The point of the director should be applied rather to the inner than to the outer part of the neck of the sac, as it will be found more easily to pass under the stricture at this part. It should not at first be attempted to be thrust under the stricture, as the firmness of the parts forming the stricture would resist it. But the seat of the stricture being felt, the operator should depress the ends of the director upon the sac, which will yield before it, and then, by an onward movement, the director slides under the stricture." (pp. 143, 44.)]

1226. The return of the intestine, the dressing and the treatment after operation are to be conducted in the same way as already described in inguinal rupture.

1227. The *external femoral rupture*, which consists in the protrusion of the *peritoneum* and of the *fascia iliaca* on the outside of the femoral vessels, between them and the front upper angle of the hip-bone, and is gradually developed, forms at the place mentioned a moderately raised swelling, which, becoming narrower below, ascends, however, obliquely inwards, and terminates with a blunt point in the region of the lesser *trochanter*. The finger cannot in the least be brought under either of its edges. If in its further growth the rupture overcome the anterior iliac *fascia*, the form and direction of the swelling is changed; a new one is developed beneath the old swelling, which always extends further between the *fascia lata* and the muscles of the thigh. The mouth of the rupture is formed by the outer part of POUPART's ligament and the iliac spine; on its inner side lies the femoral artery, and upon it the circumflex iliac artery. The neck of the sac is the widest part of it lying within the belly; its inner wall lies under the semi-lunar bridge of the posterior iliac *fascia*, its outer on the *m. iliacus internus* and *psoas magnus*. The body of the sac lies behind the anterior iliac *fascia*, near it outwardly lie the *m. rectus* and *vastus externus femoris*, near it inwardly the femoral vessels and nerves, partially covered by it, and upon or before it the *m. sartorius* and part of the *fascia lata*. The bottom of the sac, its narrowest part, lies on the *trochanter minor*. The coverings of this rupture beneath the skin are, *first*, the femoral ligament upon the inner greater half, and the *m. sartorius* upon the outer lesser half of the hernial sac; *second*, a layer of tough cellular tissue, in which small blood-vessels and nerves run; *third*, the anterior iliac *fascia*; *fourth*, the posterior iliac *fascia*, which is very delicate, and allows, *fifth*, the hernial sac, which it completely envelopes, to show through. HESSELBACH considers a weak constitution, and the existence of the *m. psoas minor*, by which a cup-like hollow is formed, as disposing to this rupture. As long as this rupture is enclosed in the anterior iliac *fascia*, it cannot well be strangulated, because the neck is the widest part of the sac; but if that *fascia* be torn by great violence, then, according to Hesselbach, strangulation may follow. The *taxis* is to be applied from below upwards; and if the operation be necessary, it is only possible, according to Hesselbach, to avoid wounding the circumflex iliac artery, which always lies in front of the neck of the sac, by the division layer-wise of the strangulating parts (*a*).

[Astley Cooper observes, that "it is by no means common to meet with deviations from the usual structure of crural hernia," and describes three varieties; *first*, that in which "the fascia usually covering the hernial sac has given way so as to allow a portion of the tumour to pass before it; thus dividing the tumour into two parts, with a sort of hour-glass contraction between them," (p. 25, part ii.) very similar to which appears Hesselbach's case, quoted by Key, where "the sheath had given way in different parts so as to givethe sac an appearance of five small tumours, which was probably owing to the apertures through which the absorbents pass having yielded, while the general texture of the sheath had resisted pressure." (p. 25, *note*, part ii.) *Second*, "when the tumour does not quit the sheath for the crural vessels." *Third*, "that in which the *hernia* is formed in part within the sheath, and also in the common way." (p. 25, part ii.)

I have had three cases of femoral rupture which seem distinct from either of those mentioned, and were furnished with a second sac, produced, I presume, by rupture of the original one.

Case 1.—S. B., aged fifty-six years, a stout, healthy, but flabby woman, was admitted into St. Thomas's Hospital on the afternoon of

Sept. 23*rd*, 1837, having been subject of rupture on the right side for the last nine years, during the latter four of which she has worn, though irregularly, a cup-truss, as the protrusion could not be entirely returned. Within the latter period the rupture has descended so largely five times as to cause severe vomiting, but has been relieved. On the 20*th ult.* her bowels were moved, and not since. Next afternoon she was attacked with severe vomiting, and yesterday the *taxis* was employed severely, but without relief, and the symptoms continued up to the period of her admission, when she was immediately put in the warm bath, which produced complete prostration, and attempts at reduction were made, but without success.

In the *evening* I saw her, and she had then recovered the effects of the bath, but she was vomiting stercoraceous matter, had continual eructations, and hiccough, which had been through the whole day, otherwise she was tranquil, and her countenance cheerful. The belly was tender, but not much distended.

A large oblong tumour extended from the pubic spine to within an inch of the upper front iliac spine, about three fingers in breadth, covering Poupart's ligament, and having the appearance of an enlarged mass of inguinal glands, very firm and unyielding, and the skin covering it very livid, from the previous severe handling. A second swelling occupied the place of femoral rupture, not exceeding the size of a walnut, separated from the former by the crease of the groin, and rather nearer the *pubes* than usual. This seemed without doubt a femoral rupture, and gave a sense of indistinct fluctuation when the swelling on the groin was pressed. I was in much doubt of the character of the larger swelling, whether it were a mass of enlarged glands further swollen and inflamed by the handling, or whether an encysted tumour, or whether a rupture; but neither its history nor situation led to the latter supposition.

As the swelling had been so severely mauled, I thought it best not to make any violent or long-continued efforts to return the rupture, and, not succeeding, proposed to her an operation, to which, however, she would not consent. The symptoms continuing throughout the night, and her countenance becoming anxious, she was at last persuaded to submit; and after consultation with my colleague Green, on the following day, *Sept.* 24*th*, *noon*, I proceeded to operate on the smaller tumour, in the same way as for femoral rupture. Nothing unusual occurred except that, on opening the sac, no fluid escaped; a portion of *omentum*, about as large as a walnut, turned out, but no intestine could be found. I then passed my finger up towards the mouth of the sac, into the aperture of which I could just introduce it. No alteration having taken place in the

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(*a*) Hesselbach above cited, and his Lehre den Eingeweidebrüchen, vol. i. p. 172.—Zeis, Dissert. Herniæ cruralis externæ historia. Lipsiæ, 1832.

tumour on the groin, and the *omentum*, in the sac just opened, seeming scarcely sufficient to account for the severity of the symptoms of strangulation, we determined on narrowly examining the sac, to ascertain whether it communicated with the large swelling. In carrying my finger round the hernial cavity for this purpose, it suddenly passed into an aperture on the outer side, and, being pushed onwards, entered the large swelling, and passing along it nearly as far as the iliac spine, could be readily felt, and not deeply, beneath the skin, which was then slit up on my finger, and thereby a large mass of healthy *omentum* exposed, which, being raised, about four inches of small intestines, chocolate-coloured and bright, but with a few patches of adhesive matter beneath its peritoneal coat, which also adhered slightly to the *omentum*, came into view. The mouth of the sac was speedily found, and my finger with little difficulty passed into the belly; but the gut would not return till the aperture had been enlarged with the knife. About four ounces of *omentum* were cut off, and the wound dressed; she recovered without an untoward symptom. I presume in this case that the hernial sac had burst, but how or when, the history of the case gave no information, and that the protruded bowel and large portion of *omentum* had no proper sac, but had merely formed themselves a cavity in the cellular tissue.

Case 2.—A. B., aged fifty-five years, a healthy, stoutish woman, of loose texture, was admitted

Feb. 24*th*, 1842, having been the subject of femoral rupture on the right side for twenty years, the latter half only of which she has worn a truss. On the morning of the 21*st ult.* her bowels were last moved, and, having exerted herself more than usual during the day, the rupture increased beyond its ordinary size, and could not be returned as previously. She was constantly vomiting during the night; and next day was bled, put in the warm bath, and had the *taxis* applied for two and a half hours without relief. The vomiting ceased in the course of the day, and nothing was done for her yesterday except giving some sulphate of magnesia in the evening, which, not operating, castor-oil was given this morning, but without relief. She has now (noon) a little hiccough, and frequent fetid eructations, but has not vomited since the 22*nd ult.* The belly is generally tender, and the pulse small; but the countenance is little distressed.

In front of Poupart's ligament there was a large swelling, extending to within two inches of the iliac spine, but not much elevated, and from its inner extremity a second swelling descended in the usual situation of femoral rupture, but pyriform rather than globular, and passing down lower in the thigh than usual. A distinct indentation existed between the two swellings, as if they were separated beneath the skin; and at this part was a scar, the result of an abscess five years ago. The fingers could be passed behind both swellings, especially the inner, which was tender; but neither were inflamed, nor appeared to have been much handled. The general resemblance to the former case was very strong. The *taxis* was employed both before and after the warm-bath, but without avail, and with her consent the operation was performed, at 2, P.M., upon the inner swelling. After cutting through, and turning off the skin and superficial *fascia*, an absorbent gland was found on Poupart's ligament, sending inwards a neck to join another below it; and three absorbent vessels were seen entering the former gland, having risen up from the femoral sheath, and by their tightness produced the depression between the two swellings already mentioned. The neck of gland was divided, and the *fascia propria*, which was very tough and almost fibrous, slit up on a director, exposing the hernial sac, which was so much larger than seemed at first, that I was obliged to widen the opening in the skin by cutting it inwards. The sac was then opened, and a small quantity of fluid escaped, followed by protrusion of *omentum;* and the cut, having been completed with a bistoury upon the finger, a knuckle of intestine, about three inches long, was found on the inner side of the swelling. I then passed my finger down to the stricture, and could enter just the tip within it; but the size of the other swelling rendered it so deep that I found it necessary to enlarge the external cut upwards previous to division of the stricture, which was made sufficient to admit the finger readily into the belly. The gut being congested, but bright, and, having examined the strictured part, and emptied it, I returned the bowel without difficulty into the belly. On carefully examining the hernial sac, in reference to the remaining swelling, I found an aperture in its outer wall close to Poupart's ligament, through which my finger readily passed into the tumour, the extent of which outwards was ascertained by the finger being buried up to the knuckle. The cavity contained nothing but soft *omentum*, which, having in vain attempted to withdraw, I thought best left alone. That *omentum*, however, in the opened sac, though healthy, being large in quantity, I cut off, having previously introduced a double ligature, and tied it on each side, which prevented any bleeding. She was then put to bed, and recovered without any hindrance.

Case 3.—A. W., aged fifty-five years, a spare, healthy woman, was admitted in the afternoon of

Nov. 4th, 1828, having ruptured herself on the right side ten years ago, since which time she has worn a truss constantly, which, however, has not fitted, and the rupture has been so much incarcerated five or six times as to need assistance for its reduction; but it does not appear certain, from her account, that its entire contents have been always returned. Yesterday evening, (her bowels having been twice relieved during the day,) whilst engaged in her usual occupation, mangling, the rupture came down beneath the truss, which she took off, and, having returned the protruded parts, felt no farther inconvenience till 11 o'clock this morning, when it again came down, and, having attained larger size than usual, became painful, and made her sick and faint. She could not return the rupture, nor could her medical attendant, who twice employed the *taxis* during the afternoon, and then sent her on that evening to the hospital, where the warm-bath and *taxis* were resorted to, but without avail. When I saw her, at 6, P.M., she had been constantly retching for the last five hours, and so continued, raising, however, nothing more than a little transparent, colourless fluid. She had frequent eructasions, increased by any pressure on the swelling; the belly is full, but not tender, and the complains only of pain at the lower part, near the rupture; pulse small; countenance pallid and anxious; the bowels have not been relieved since yesterday.

Upon POUPART's ligament was a large tumour of an oblong shape, extending from about three fingers' breadth to the inner side of the upper iliac spine, into the right *labium pudendi*. It was more prominent, bulky, and rounded, at its outer end, gradually narrowed as it proceeded inwards, and reaching the lower part of the *mons Veneris*, bent down at an angle, and descended for the distance of an inch into the *labium*. The upper outer part of the swelling was firm and unyielding, but the labial portion soft and fluctuating on pressure. The appearance of the tumour, which was such as might be supposed to depend on inguinal and femoral rupture existing simultaneously, rendered the *diagnosis* puzzling. But finding it possible to get my fingers under both ends of the swelling, although I could not pass them behind its centre, I concluded that the case was one of femoral rupture, accompanied with variety. This view was supported by the patient's statement, that till this morning, although often very large, the swelling had always been in the thigh alone, and not in the *labium*, where it first appeared only to-day. As the case was one of which I knew none like, I gladly availed myself of my friend the elder TRAVERS's kind opinion, which, concurring with my own, it was determined to operate as for femoral rupture. At

9, P.M., a transverse cut was made from the middle of the firm swelling inwards, nearly to the spine of the *pubes*, and a second at right angles with and below it. The other coverings were then divided in the usual way, and on opening the hernial sac, a little dark-coloured *serum* escaped; and when it was fully divided, forthwith a quantity of *omentum* burst through the aperture, and the swelling in the *labium* at once subsided. This portion of *omentum* was very soft and loose in texture, and had been, doubtless, that last descended; but the remainder, forming the bulk of the swelling, was firm and matted together, and upon raising it a knuckle of intestine was seen, dark-coloured but bright and œdematous. Having introduced my finger into the sac, I could not at first pass it down to the stricture, as it was intercepted by a band, which I supposed to be an old adhesion; but having drawn the *omentum* and gut to the outer side, I was enabled to reach, and found the stricture very tight, and admitting only the tip of the finger, but sufficient to allow the entrance of the blunt-ended bistoury, with which I divided, till my finger would pass into the belly, up to the second joint. I then readily emptied the gut, and attempted to return it, but could not succeed. It was thought that the difficulty depended on the stricture not having been sufficiently freed, and I therefore prepared again to introduce the bistoury, by drawing the *omentum* and intestine to the outer side. This, however, being done, a broad membrane was seen descending from the upper part of the sac, behind which the finger could be passed. It was this, doubtless, which first prevented the introduction of my finger into the stricture, and subsequently obstructed the entrance of the gut into the belly by dropping against the mouth of the sac. We determined on its division; and this done without further dilatation of the stricture, the intestine easily returned. The *omentum* was partially adherent to the mouth of the sac, and being in rather large quantity, and its matted part rather bruised, the greater portion of it was removed, and three little vessels in it disposed to bleed were singly tied. The sac having been thus emptied, was found to be of large size, extending rather more outwards than usual; and on its inner side, the finger being pressed, readily passed inwards, and for an inch and a half downwards into the right *labium;* but whether this part of the cavity had any peritoneal lining, I did not observe. She recovered without any drawback.

In January, 1842, she again came under my care with symptoms of strangulation. She had constantly worn the truss, but not to much purpose, as the rupture has come down four or five times a week. The original femoral swelling had now increased to the size of a large fist, and filled up a considerable part of the inguinal region both below and above POUPART'S ligament. On its inner side, the part which had descended into the *labium* was also enlarged, and its fore and upper part had assumed a remarkable form, exhibiting the appearance of the *appendix auriculæ* of the heart, with its loose extremity projecting upwards and forwards. This labial part of the swelling was very hard and firm, and its contents seemed solid, whilst the outer and larger portion was evidently filled with intestine, which could be readily felt, as the skin alone appeared to cover it, and pressure caused much gurgling.

The rupture was returned, after the warm bath, by emptying the smaller into the larger swelling, which having been done with some difficulty, the aperture between the two was grasped tightly, so as to prevent any escape, the larger swelling being thrust into the thigh by an assistant. I again employed the *taxis* upon it, and the rupture was slowly but completely returned into the belly. The mouth of the sac was large enough to admit the entrance of two or three fingers, and through the inside, the fingers could be readily passed into the appendicular swelling, and to the bottom of the *labium*.—J. F. S.]

1228. Wounding the epigastric or obturator artery, or one of their branches, in the operation for inguinal or femoral rupture, may cause a fatal or alarming bleeding, the more, as the blood is commonly poured into the cavity of the belly. By proper consideration of the points mentioned in the several kinds of these ruptures, this injury may indeed always be prevented. For stanching the bleeding, compression with oak agaric, plugs of lint moistened with styptics, with peculiar instruments, (DESAULT, by means of broad compressing forceps, SCHINDLER, with forceps having a hinge, HESSELBACH, with a peculiar compressor, HAGER, with the compressor for the middle meningeal artery,) the passing a needle around the bleeding vessel, the enlargement of the incision, and special tying the vessel, have been proposed. HESSELBACH'S instrument (*a*) seems to have the preference; with its spoon-shaped part we must endeavour to find the seat of the bleeding, as when it is passed into the belly, the blood in that cavity escapes externally, which, however, is better done by introducing the forefinger. The spoon-like part is then to be placed on the wound of the vessel, the other broad part, on the front wall of the belly, and by means of a screw, the two parts are to be pressed together. A cold application assists the operation of this remedy.

[Although it cannot be doubted that wounds of either the epigastric or obturator arteries are very dangerous accidents, yet it is very remarkable that with the frequent variety of their origin and in the great number of operations for strangulated rupture, such cases are exceedingly rare, the number collected by LAWRENCE being not more than twelve or fourteen. In one of these, "the epigastric artery had been completely divided at three quarters of an inch from its origin, and it did not appear that the smallest quantity of blood had escaped from the divided vessel;" in another, in enlarging the stricture, "the wound immediately filled with arterial blood, which rose again almost directly to the edges of the incision when removed with the sponge. * * * The patient lost about a pint of blood, fainted, and the bleeding ceased, nor did it come on again." (p. 271.) In other cases, however, the patient died of the bleeding, either with or without the mischief having been discovered.

If there be reasonable ground to suppose that either artery is wounded, the proper proceeding is to seek for and tie it, which was done by MACKAY with success (*b*).

It is also remarkable that the bleeding does not always come on immediately at the operation; but from the two following cases it appears that this may arise from other

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(*a*) HESSELBACH, F. K., Beschreibung und Abbildung eines neuen Instrumentes zur sichern Entdeckung und Stillung einer bei dem Bruckschnitte entstandenen gefährlichen Blutung. Ein Anhang und Beitrag zu den neuesten anatomisch pathologischen Untersuchungen über die Leisten und Schenkelbrüche. Würzburg, 1816; with two copper-plates.

(*b*) A. COOPER, p. 41.

arteries than either obturator or epigastric. **Lawrence** mentions a case of strangulated bubonocele in which "no blood was shed during the operation; hæmorrhage, however, took place on the same evening, but yielded to the application of cold cloths." There was no further bleeding till "the morning of the eighth day, when a profuse hæmorrhage took place from the wound; it consisted of arterial blood, and did not cease till two pints at least had been lost. He survived this occurrence about a week." The vessel which had been divided was "the arterial branch, which the epigastric sends to the spermatic cord; but its size did not seem adequate to the supply of so profuse a bleeding." (pp. 273, 74.) **Everard Home** (*a*) also relates a case of strangulated scrotal rupture, in which suppuration of the testicle having followed the operation, "a hæmorrhage took place in the evening (of the tenth day), which made the removal of the testicle necessary in order to secure the vessel. He lost a pound of blood;" but ultimately recovered. (p. 109.)]

III.—OF UMBILICAL RUPTURE.

(*Hernia umbilicalis, Exomphalas*, Lat.; *Nabelbruch*, Germ.; *Hernie ombilicale, Omphalocèle*, Fr.)

Desault, Œuvres Chirurgicales, vol. ii. p. 315.

Cooper Astley, Anatomy and Surgical Treatment of Abdominal Hernia, part ii. p. 29.

Oken's Preisschrift über die Entstehung und Heilung der Nabelbrüche. Lanshut, 1810.

Soemmering, S. T., Ueber die Ursache, Erkenntniss und Behandlung der Nabelbrüche. Frankfurt, 1811.

Thurn, Ueber die Ursachen der Nabelbrüche, bei Kindern und deren Heilung besonders durch Abbinden; in **Von Siebold's** Chiron., vol. ii. part ii. p. 3.

Müller, H., Inaug. Abhandl. über den Nabelbruch, mit einem neuen Vorschlage zu seiner Behandlung. Enlangen, 1841.

1229. The *True Umbilical Rupture* passes through the opening of the navel, and is thereby distinguished from the so-called *false umbilical rupture*, which is formed in the neighbourhood of the navel. Umbilical rupture, is either *congenital*, or *arises accidentally* after birth.

1230. Congenital Umbilical Rupture is the consequence of an arrested development of the *fœtus*, of a backward formation of the abdominal muscles, the *fœtus* remaining in that earlier stage of development, in which the intestines have not yet entered into the cavity of the belly. This rupture is situated in the spongy cellular tissue which connects the vessels of the navel-string together. It is therefore on this account opaque, where covered by the integuments of the belly, but transparent over the rest of its extent where surrounded by the cellular tissue of the navel-string. Besides this cellular tissue, this rupture is also enveloped in a hernial sac, and lies in a triangular space, which is produced by the separation of the vessels of the navel-string from each other. The veins are always above, the two arteries below and on the sides. The size of this rupture varies according as it contains a larger or smaller quantity of intestines. Several portions of the small intestines are usually contained in the swelling; frequently, also, the *colon*, *omentum*, stomach, liver, and spleen.

[In tying the umbilical cord after birth, care should be taken to ascertain previously whether there be any protrusion of *viscera* into it, which sometimes having, from the small size of the rupture been overlooked, intestine has been included in the ligature, and wounded; instances of which are mentioned by **Mauriceau** (*b*), **Sabatier** (*c*), and others.—J. F. S.]

(*a*) Cases and Observations on Strangulated Hernia, in Trans. of a Society for the improvement of Med. and Surg. Knowledge, vol. ii.

(*b*) Traité des Accouchemens, vol. i. p. 497.

(*c*) De la Medecine Opératoire. vol. i. p. 152.

1231. Umbilical rupture after birth occurs, from the time of the separation of the navel-string to the third or fourth month. If circumstances, as violent screaming, restlessness of the child, and the like, then operate, which force the intestines violently against the walls of the belly, a portion of *peritoneum*, and of intestine, is easily thrust through the still open navel-ring, or the scar, not yet firm, gives way.

As the navel, after the proper obliteration of the *annulus umbilicalis*, must be considered as the firmest part of the abdominal wall, it is probable that in the cases where true umbilical rupture has been observed in adults, it had already formed in childhood, but, on account of its small size, had been overlooked; or that the navel-ring is enlarged, as a consequence of great extension of the abdominal wall, in fat persons, or after frequent pregnancies. Umbilical rupture, in adults, is, therefore, more frequent in women, who have been often pregnant, after great extension of the belly from dropsy, and in very fat persons. Umbilical rupture occurring after pregnancy, has a round, sometimes cylindrical, sometimes conical form, and a circular base; in large swellling, the scar of the navel is more or less smoothed. The coverings of this rupture are:—1, the external skin; 2, the delicate *aponeurosis*, which spreads over the external surface of the abdominal muscles; 3, the *peritoneum* lengthened into the hernial sac. The latter is often very thin, and more often, adherent to the coverings and to the intestines, especially at the point of the swelling; it seems also deficient, and is sometimes torn. The neck of the sac is always very short, and connected internally with the aponeurotic navel-ring; in old and large umbilical ruptures it is tough, and often cartilaginous. In such ruptures, very considerable adhesions exist between the protruded intestines, themselves, and the hernial sac, so that they form an inseparable mass, and the contained intestines can only be returned with difficulty. Collections of stool may therefore occur in that part of the intestine between the rupture and the navel, vomiting, and the like. Actual strangulation is rare in umbilical ruptures; if, however, it occur, the symptoms are more severe than in other ruptures, and more rapid mortification is to be dreaded.

[ASTLEY COOPER mentions "an example of the sac having been either absorbed or burst, by which openings have been formed, and portions of *omentum* protruded through the sac of the larger one."

Sometimes an umbilical rupture forms two tumours, of which ASTLEY COOPER mentions an instance operated on by the elder CLINE, who, "after returning the intestine from the hernial sac, on putting the finger into the *abdomen*, an opening could be felt about half an inch from that by which the finger passed, which led into another tumour by the side of the former." (p. 31.) On *dissection*, in the tumour that was most inferior "I found," says COOPER, "a small portion of the *ileum*, and part of the *cæcum*. In the other tumour there was a portion of *colon*, and which adhered to the sac." (p. 47.)

I have had a case (No. XI. in the Table) somewhat similar, in which the rupture, about the size of a half-quartern loaf, had somewhat the shape of the figure 8, the head of which was rather smaller, and bent over to the left side. In the course of the operation a deep tough band of cellular tissue was found thrusting down the middle of the hernial sac, which retained the indentation after the cellular band had been cut through. The sac contained a large quantity of hard impacted *omentum*, and some inches of intestine. —J. F. S

Umbilical Ruptures sometimes acquire "enormous size in women, whose bellies are pendulous, from bearing a great number of children. In three such instances," says COOPER, "I have seen the *hernia* extending so low from the navel as entirely to cover the *pudendum*;" the largest he ever saw "measured across twenty inches by seventeen." (p. 34.)]

1232. In congenital umbilical rupture, it depends on its size and on the condition of the walls of the belly, whether anything can be undertaken for its cure. If that part of the intestine, external to the belly, be not large, and be reducible, its return must be carefully effected and re-protrusion prevented, by graduated compresses, which should be fastened with strips of sticking plaster and a body-belt. This practice is preferable to that followed by HAMILTON, who after returning the intestine, applied a stout bandage around the base of the swelling, and brought the edges of the abdominal coverings together, with two silver needles and sticking plaster, and the cure was effected in a few days (*a*). If the congenital rupture be considerable, and its return in a gentle manner not possible, the child usually dies soon after birth, in which case, the external covering of the swelling is thrown off and the intestines are laid bare. Experience, however, proves, that if the swelling be properly protected from all external pressure, granulations may be produced after separation of the external covering, and thus the whole part be gradually covered with firm skin and a tendinous expansion (*b*).

1233. The *treatment* of umbilical rupture occurring after birth, is easy. The parts are returned without difficulty, and are kept up with a convex pad of wood, wax, or the like, applied close to the navel-ring, and properly fastened with sticking plaster, and a broad bandage. In changing the dressings, especial care must be taken that the protrusion of the intestine be prevented, by pressure of the finger on the navel-ring, till the pad be again properly applied. Usually, in children, a radical cure very soon takes place, on account of the natural tendency of the navel-ring to obliteration. In adults, elastic trusses, which yield to the motions of the abdominal muscles, are employed. Of the many, and some very complicated umbilical trusses, an elastic truss of a similar kind to that for inguinal rupture is preferable, of which the spring should be well fitted to the fulness of the belly, and its pad project directly from the spring; or a somewhat concave metallic plate, to which is attached a spring, with a pad, and kept in its proper place by an elastic bandage attached to both sides of the plate; or a plate of horn is applied, in the middle of which is screwed a pad, and fixed with a large, tight, sticking plaster, and a belly-band, by which the rupture can be most certainly kept up. If the rupture cannot be returned, a large hollow pad must be used, by which the increase of the rupture is prevented.

ROTHMUND (*c*) after completely replacing the contents of the hernial sac, presses the external coverings and the hernial sac through the mouth of the sac into the belly, and thrusts a round plate, corresponding in size to the extent of the aperture, into the pouch thereby formed. On this plate, which can be kept steady by a stem projecting in its middle, a contrivance is to be attached, which can increase it from two to four lines at the greatest part of its periphery. By drawing the stem, the enlarged plate, which no longer can escape out of the mouth of the hernial sac, is firmly applied against the inner hinder wall of the latter. A somewhat larger plate, with an opening in its middle, corresponding to the inner plate, is applied on the coverings of the belly, and then the projecting stem of the first is to be passed through the opening of the second, and fastened by a contrivance attached to it. In this way the ensheathed hernial sac may be firmly compressed, at pleasure, at the whole hinder extent of the mouth, to the extent of some lines; and by this gradually increased pressure, after some days, adhesive inflammation is excited, by means of which the mouth of the hernial sac is closed, the compressed parts of the ensheathed sac at the hind surface of the navel-ring becoming adherent to it, and to the umbilical canal. This compressor cannot generally be borne more than three, and at most, five days. If the ensheathed hernial sac look livid, the

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(*a*) COOPER, above cited, p. 32.

(*b*) RIBKE, Heilung eines in der ersten Bildun- und im Mangel der aüsseren Hantdecken begrüng deten Nabelbrückes; in RUST's Magazin, vol. viii. pt. i. p 130.

(*c*) MÜLLER, above cited, p. 53.

the compressor must at once be removed. The compressors are made of wood and metal (*a*).

[" The presence of the intestine and *omentum* in the tumour keeping the navel open, oppose," says Desault, " its continual tendency to close; a tendency, however, which sometimes becoming greater than the resistance of the escaped parts, compels their return into the belly, obliterates the aperture which has given them passage, closes, consolidates it, and hence spontaneous cures of infantile umbilical ruptures occur." (p. 317.) He gives two instances of this fact. The one, a female child of two years of age, with a rupture the size of a large nut, which had occurred soon after birth, and for which nothing had been done. He proposed applying a ligature, but the parents would not permit it. In the following year he saw the child again, and the rupture had disappeared. Nothing had been done, but the tumour had gradually subsided. In the other case the rupture had existed from birth, and at five years of age it was determined on applying the ligature. It was however deferred, in consequence of an attack of small-pox. After the child's recovery the swelling was found much diminished, and Desault, presuming it might be cured by nature, left it alone. He was right; at the end of eight months it had entirely disappeared. Soemmering (*b*) and Brunninghausen (*c*) have mentioned several similar instances.]

1234. If the operation be necessary in strangulated umbilical rupture, the opening must be carefully made into the swelling, because the covering, are often very thin, and the hernial sac adherent to the skin, or intestines, or torn. The cut through the coverings should be made perpendicularly. If after opening the sac, and the proper disentanglement of the intestines, and so on, reduction cannot be effected, a director must be introduced between the neck of the sac, and the navel-ring cut into downwards with the button-ended bistoury. If previous to the operation, the impossibility of returning the rupture, on account of the existing adhesions, should be perceived, if the parts of the rupture be not gangrenous, a semilunar incision is to be made at the bottom of the swelling, on the right or left side, through the skin, the thin *aponeurosis* carefully divided, and a director attempted to be introduced at the upper or under part of the navel-ring, between it and the neck of the sac, and upon it the button-ended bistoury for cutting into the navel-ring; or if this be not possible, the point of the left forefinger, with the nail turned down, is to be placed between the neck of the hernial sac and the under edge of the navel-ring, and upon it a cut with a straight bistoury is to be carefully made from without inwards with a gentle motion of the hand. But if the parts in the rupture be gangrenous or self-strangulated, the sac may be carefully opened at any convenient place. The further treatment is to be guided according to the ordinary rules.

[Astley Cooper mentions " one circumstance of danger which is peculiar to the umbilical *hernia*, which is, that when the skin has become very thin over the tumour, the pressure simply of the protruded parts, under strangulation, will sometimes very early destroy the life of that portion of the integument by stopping the circulation through it. It first turns green, the cuticle then separates from it, and that portion of the skin becomes dry and of a brown colour; and in the instances in which this circumstance came under my observation the patients have died." * * * " Suppuration," he also observes, " now and then takes place in the *omentum* of an irreducible umbilical *hernia*." (p. 35.)

As pregnancy is not an unfrequent cause of umbilical rupture, it is rather curious that strangulation at this period so rarely occurs. If it cannot be overcome by the usual remedies, the operation may be resorted to without the patient's condition rendering it less hopeful. Astley Cooper mentions one case operated on successfully in the eighth month of pregnancy (*d*); Lawrence one in the seventh or eighth month (*e*); and Clement another in the fourth month (*f*).]

(*a*) Müller, pl. v.

(*b*) Above cited.

(*c*) Loder's Journal für Chirurgie, vol. ii. p. 1.

(*d*) Above quoted, part ii. 347.

(*e*) Above quoted, p. 560.

(*f*) Observations on Surgery and Pathology p. 123.

1235. The radical cure of reducible umbilical rupture, in young persons, by the application of a ligature, after the reduction of the intestines, around the integument covering the rupture, by tying which tightly the parts taken hold of are destroyed, and a tough scar formed (1), is generally exceptionable ; because, firstly, umbilical rupture is very commonly cured in children by the mere powers of nature ; secondly, because the cure can certainly be effected by continued moderate compression ; thirdly, because the operation is very painful, even dangerous, (as a small part of an intestine may be included in the ligature,) and after the scarring of the suppurating parts, compression is necessary for a much longer time ; fourthly, because no decided radical cure can be effected, as a part of the neck of the hernial sac always still remains, and the scar produced is not sufficiently firm to prevent the dragging of the intestine. In female children, it must also be remembered that in pregnancy the scar may be torn (*a*). But in all the umbilical ruptures, which are several inches long, and purse-shaped, if the firm application of a truss be prevented by the great lengthening of the skin the ligature may be proper ; and if it do not effect the closing of the navel-ring, the close application of a truss may be rendered possible (*b*).

(1) In former time this was recommended and practised by PAULUS ÆGINETA, ALBUCASIS, PARÉ, and others ; objected to by GUY DE CHAULIAC and DIONIS, and again recommended, especially by DESAULT (*c*), VON GRÄEFE, and others.

[SCARPA, ASTLEY COOPER, and others, are much opposed to the ligature. BENEDICT of Breslau has also abandoned it on account of the serious, if not dangerous, symptoms resulting from its use. He says (*d*) :—" In all the cases, pain in the belly came on about the third day, with great tenderness to the touch, especially near the navel, and considerable fever, so that the presence of peritoneal inflammation could not be mistaken ; in one instance there was also vomiting. All the patients recovered under antiphlogistic treatment ; but the symptoms were so formidable for two days, that a Surgeon would not be justified in employing this treatment unless all other measures had failed." And its my opinion he would not be justified even then ; for it is asserted by RICHERAND (*e*) than many of DESAULT's cases, supposed to be cured, returned. A case is also mentioned (*f*) in which a child of seven and a half years old died in consequence of such treatment, the operation being thus performed ; " the patient was placed on her back, the contents of the *hernia* were returned, and the sac was raised and twisted to insure the reduction. A flat buckskin ligature, three-fourths of an inch wide, was applied close to the *abdomen*, not so firmly as to strangulate the parts, but sufficiently to retain the *viscera* and excite adhesive inflammation in the sac. A strong silk ligature was then applied with sufficient firmness to interrupt all circulation. When the mortified part was cut away, it was found that a portion of *omentum* had adhered to the sac, and of course had been included in the ligature. The patient died on the tenth day. The ring was perfectly closed by adhesion and granulation, which sprung from its tendinous margin ; the *colon* adhered to the inner surface of the granulations ; no inflammation could be detected in any part." (p. 368.) It must be admitted that in this case circumstances were not very favourable as to the success of the operation. " The mouth of the sac presented a diameter of three inches, and the enormous tumour extended to the knees. The swelling measured at the neck twelve inches in circumference ; six inches lower it was fifteen inches; it was seventeen inches in length ; and two extensive ulcers existed on it posterior surface" (*g*).—J. F. S.]

(*a*) SCARPA, above cited.—GIRARD, Mémoire sur la Hernie ombilicale chez des enfans ; in Journal Général de Médecine, vol. xli. July, 1811.

(*b*) GUINCOURT ; in Journal de Médecine par CORVISART, &c., vol. xxi. 1811.—WALTHER ; in Salzburg Med.-chirurg. Zeitung, vol. i. p. 426. 1814.

(*c*) Above cited, p. 324.

(*d*) RUST's Magazin für die Gesammte Heilkunde vol. xliv. p. 176.

(*e*) Nosographie Chirurgicale, vol. ii. p. 453.

(*f*) American Journal of the Medical Sciences vol. xvii.

(*g*) For the above quotations I am indebted to LAWRENCE's work on Hernia.—J. F. S.

IV.—OF VENTRAL RUPTURE.

(*Hernia ventralis*, Lat.; *Bauchbruch*, Germ.; *Hernie ventrale*, Fr.)

Garengeot, Sur plusieurs Hernies singulières; in Mémoires de l'Académie de Chirurgie, vol. i. p. 699.

Pipelet, Nouvelles Observations sur les Hernies de la Vessie et de l'Estomac; in the same, vol. iv. p. 188.

La Chausse, B. J., Dissert. de hernia ventrali. Argent., 1746.

Klinkosch, Progr. quo divisionem herniarum novamque hernia ventralis speciem proponit. Prag., 1764.

Soemmering, S. T., Ueber die Brüche am Bauche und Becken, ausser der Nabel-und Leistengegend. Frankfort, 1811.

Cooper Astley, above cited, part ii. p. 49.

1236. A *Ventral Rupture* is that which protrudes through an unnatural opening on the front or side of the belly. This rupture is much more rare than either of those already mentioned. It takes place through openings in the abdominal muscles, and their *aponeuroses;* most commonly in the space between the two *m. recti*, more rarely on the sides of the belly, from the hip-bone to the last rib, and in the lumbar region (*Lumbar Rupture*) (1).

The *causes* of this rupture are the ordinary occasional causes of rupture, with existing relaxation of the abdominal walls, especially of the white line, after many pregnancies, in quick emaciation after previous stoutness; or it is caused by tearing of the muscles and *aponeuroses*, at the parts where scars have formed (2). Or the entire walls of the belly often spread into a sac which contains intestines (3). These ruptures are generally provided with a hernial sac, except when they are consequent on previous wounding of the *peritoneum.*

[(1) Of this very rare form of Ventral Rupture Cloquet gives an instance in a man of seventy-five years, who, whilst lifting a heavy mattress, felt a violent pain, with a sense of tearing in his loins, which gradually subsided in course of six weeks. But about a fortnight after, whilst getting up in his bed, he had a fresh attack of pain at the same spot. When seen next day he was much agitated, had violent colic, some *nausea* and vomiting, and his bowels were costive. The skin in the right lumbar region, without being discoloured, was raised slightly by a rounded swelling about five inches from the spines of the *vertebræ.* It was little tender, and when grasped, was found to be somewhat elastic, crackling, deeply situated, or at least separated from the skin by a layer of fat. It had a broad pedicle, increased in bulk, and dilated on coughing, sneezing, and making water. He had severe and constant pain deep in the right lumbar and iliac regions in the course of the *cæcum* and ascending *colon.* The swelling was much larger when he stood up than when lying down, and when he turned on his face it disappeared, and left a hollow readily distinguishable by the touch. He was treated by putting a pad upon the seat of swelling, after its contents had been returned, and confining it with a circular bandage. (pp. 5, 6, *note*)

(2) I have seen two or three cases in which, after pregnancy, the *linea alba* has been torn to the extent of several inches; and in one of them below the navel I well recollect I could, without difficulty, bury my whole hand in the cavity of the belly, thrusting in the skin as a large pouch before it. In neither of these cases, however, was the protrusion of the bowels very considerable. There did not seem to be anything remaining but the skin alone.—j. f. s.

Lawrence mentions a very interesting case of a woman who strained herself by lifting a heavy table, and died from inflammation of the chest. She had complained only of pain in the loins. But on examination both *m. recti abdominis* were torn through about one third of their thickness, and there was a small quantity of coagulated blood about the torn fibres; but the sheath was not ruptured. (p. 583.) Probably, had she lived, this would have become a ventral rupture. In reference to wounds of the belly, which are sometimes followed by ruptures, he mentions, as an example, that this does not always occur. The case of a boy who had been largely gored by the tusk of a boar, and had the greater part of the stomach distended by a hearty dinner recently taken, the *omentum*, the transverse arch of the *colon*, and some small intestines protruded through the wound; they were returned with difficulty, and having been retained by the uninterrupted suture the case did well, and no rupture followed. (p. 584.)

(3) Of the latter kind, in which a portion of the entire abdominal wall seems to yield, various instances are mentioned. RICHTER describes a broad swelling, as large as a woman's breast, in each groin of the same person (*a*). And SIEBOLD describes one equal to a loaf of bread in size, between the cartilages of the ribs and navel (*b*).]

1237. These ruptures may happen through the whole length of the white line (*Herniæ lineæ albæ*); but they are more commonly observed in that part above the navel, than in that below it. They for the most part contain a portion of *omentum;* if they be below the navel there usually lies in them a small piece of intestine, frequently the bladder or the womb. They often protrude so near the navel as to be easily mistaken for umbilical rupture. They have always an oval form, and have little prominence in comparison with their size; their neck is always oval, like the cleft through which they have passed; the neck of the sac is always very narrow in comparison to its size. If quite close to the navel-ring, they are distinguishable from true umbilical rupture by the oval shape of the neck of the sac, and by the navel being seen on one or other side of the swelling. Ruptures in the white line happen most frequently in women; their coverings are the same as those of umbilical rupture. They are kept up by the same trusses as the latter; but their radical cure is by far more rare than that of umbilical rupture. If there be strangulation, and the operation be necessary, it is the same as that for umbilical rupture; only the opening into the belly is best enlarged on one side or other.

1238. From these ruptures of the white line must be distinguished, those swellings formed by a portion of fat which has penetrated through a cleft in the white line, and have great resemblance to the omental ruptures of the white line. These swellings feel hard, are insensible, irreducible, and produce no inconvenience. If such swelling be accidentally accompanied with colic, a mistake is very easy. (Compare *par.* 1203.)

1239. At the upper part of the white line, and on the left side of the ensiform process, little ruptures not unfrequently arise, which, on account of the severe irritation of the stomach connected with them, may be called *Stomach Ruptures*, *(Herniæ ventriculi*, *Gastrocele*,) but they usually contain a part of the transverse *colon* (*c*). They are often so small as to be scarcely perceptible, have usually the size of an olive, and are rarely larger. They produce, without being strangulated, pain, dragging at the stomach, great tenderness of the pit of the stomach, vomiting, hiccough, *nausea*, especially after eating; and these symptoms diminish in the supine posture. The swelling is only felt when the patient stands up, or when the body is bent forward. The cleft through which the rupture protrudes may be, perhaps, felt in coughing. For the purpose of keeping up this rupture, it is best to wear stays made of whalebone, which, at the part corresponding to the rupture, are furnished with a pad of sufficiently large size.

1240. The *treatment* of the other Ventral Ruptures agrees, except in some slight modifications, with that for ruptures of the white line. If

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(*a*) Abhandlung von den Brüchen. Second Edit., translated into French by ROUGEMOUNT, p. 7. Bonn, 1788. 4to.

(*b*) LA PEYRONIE; in Mem. de l'Acad. de Chirurgie, vol. iv.—LITTRE; in Mem. de l'Acad. des Sciences. 1714.

(*c*) In LODER's Journal, 1797, vol. i. p. 215.

strangulation render the operation necessary, the dilatation of the stricturing part must be made in such direction that no important vessel shall be injured, and as much as possible directly upwards.

V.—OF ISCHIATIC RUPTURE.

(*Hernia ischiatica, dorsalis, iliaca posterior,* Lat.; *Hüftbeinbruch,* Germ.; *Hernie ischiatique, Ischiocèle,* Fr.)

1241. *Ischiatic, Dorsal Rupture,* passes through the notch of the haunch-bone, above the sacro-ischiatic ligaments and pyriform muscle, below the gluteal muscle, and appears externally near the lower part of one of the lateral edges of the rump-bone, or *coccyx;* it attains often a considerable size, extending more either upwards and backwards, or outwards, towards the *perinæum.* It contains, either merely intestines, urinary bladder, or both small and large intestines, the womb, and the like, together. It is undecided whether the male or female sex be more subject to this rupture. It is more frequently noticed on the right than on the left side. It may be congenital, or may occur subsequently.

The various cases of this rupture described are those of—

Papen, C. H., Epistola ad illustr. virum Alb. de Haller de stupendâ herniâ dorsali. Götting., 1750; in Haller's Disput. Chirurg., vol. iii. p. 314.

Verdier; in Mémoires de l'Académ. de Chirurgie, vol. ii. p. 2, note *a.*

Camper, Demonstrationes anatomico-pathologicæ, lib. ii. p. 17.

Rose, Progr. de Enterocele ischiatica. Lips., 1792.

Lassus, Pathologie Chirurgicale, vol. ii. p. 103.

Cooper, Astley, above cited, p. 66.

Schreger, Chirurgische Versuche, vol. ii. p. 156.

Berzold; in Siebold's Samml. chirurg. Beobact., vol. iii. p. 292, pl. iii.

Monro, Anatomy of the Gullet, Stomach, and Intestines, Edinb., 1811, p. 380.

Hager, above cited, p. 275.

Roubein, Annales cliniques de Montpellier, vol. viii. p. 354.

1242. The *diagnosis* of this rupture is very difficult. Whilst it is small and covered by the great gluteal muscles, it cannot be discovered. In making the *diagnosis,* we must first remember the seat of the swelling; the suspicion of a rupture is so much the greater when it is congenital, and has a form, namely, a globular form, which other swellings generally have not. It can only be determined when the intestine can be felt in the rupture, which may be returned, and again protrude. In small ruptures the convolutions cannot be at all felt; and even without adhesions, the return of this rupture may be impossible, on account of the small size of the aperture by which it has escaped. In large ruptures, an emptiness of the belly is noticed.

Congenital ischiatic rupture first begins with a broad base from the body, but in larger ones the neck is narrower than the bottom. As the urinary bladder can alone lie in dorsal rupture, so must the symptoms of vesical rupture be remembered in the *diagnosis.* The distinction of this rupture from a fatty or encysted swelling is difficult; it may be easily mistaken for an abscess when it proceeds to suppuration. *Spina bifida* is distinguished from this rupture by its seat in the middle of the rump-bone, by its fluctuation, and, in most cases, by its transparency.

1243. As in this rupture the pelvic *aponeurosis* is ordinarily torn and not displaced with it, it is covered only by skin, and by the outspread, or divided fibres of the *m. levator ani.* The sac of the rupture lies between the under inner edge of the great gluteal muscle and the side of the *rectum.* On the inner side of the hip-bone, the neck of the sac is immediately surrounded by the obturator artery, both above and below. Upon the outer side of the hip-bone, the ischiatic nerve lies before and below, and the gluteal artery behind (A. COOPER) (*a*).

1244. Small dorsal ruptures may be easily reduced; they return of themselves into their proper place. Large and more long-continued ruptures are capable of a slow reduction by a continued suitable position and external pressure. Reduction may be impossible on account of adhesion, or if the greater number of the abdominal organs be contained in the rupture, on account of the contraction of the walls of the belly. According to ASTLEY COOPER, if ischiatic rupture render the operation necessary, and the extension of the mouth of the sac cannot be effected with a blunt hook, it must be divided forwards. SEILER considers it absolutely necessary in dividing the mouth of the sac, to cut layerwise from without inwards, and to tie the divided arteries immediately.

HAGER (*b*) distinguishes an *upper* and *lower* ischiatic *rupture;* the one should descend above the *m. pyriformis*, the other between it and the ischiatic nerve and the upper of the *m. gemini;* the one has at its escape from the ischiatic hole the upper gluteal artery above and behind, and the nerve below it; the other has the lower gluteal artery, the pudic artery and vein, and the nerves below it. It is best not to open the hernial sac, and in the superior ischiatic rupture, to divide its mouth forwards and outwards, but in the inferior, forwards and upwards.

SCARPA (*c*) considers this in women as enlarged pudic rupture, and in men as large perineal rupture, and therefore treats them as such. This opinion is perhaps right as regards some of the above-described cases, for instance, those of PAPEN and BOSE; but it is contradicted by other cases in which there has been sufficient anatomical examination.

VI.—OF THYROID RUPTURE.

(*Hernia Foraminis ovalis seu thyroidei*, Lat.; *Bruch des eirunden Loches*, Germ.; *Hernie du Trou ovalaire*, Fr.)

GARENGEOT, above cited, vol. i. p. 709.

HEUERMANN, Abhhandlung der vornehmsten chirurg. Operationen. Copenhagen, 1778, vol. i. p. 578.

ESCHENBACH, C., Observata quædam anat.-chirurg. medica rariora. Rostoch., p. 265.

GÜNZ, De herniis, p. 96.

VOGEL, B., Abhandlung aller Arten der Brüche. Glogau, 1769. 8vo. p. 204.

CAMPER, Demonstrationes anat. pathol., vol. ii. p. 17.

CLOQUET; in Journal de Médecine par CORVISART, etc., vol. xxv. Bulletin de la Faculté de Médecine, No. 8, 1812, p. 194.

BUHLE, De herniâ obturatoriâ. Hal., 1819.

GADERMANN, Ueber den Brüch durch das Hüftbeinloch, nebst einem seltenen Falle hierüber. Lanshut, 1833. 8vo.

COOPER, ASTLEY, above cited, part ii. p. 61.

CLOQUET, J., Pathologie chirurgicale. Paris, 1831. pl. v.

1245. In *Rupture of the Thyroid Hole*, the intestines pass through the opening in the ligament by which the obturator nerve and vessels pass The share-bone is in front of the neck of the sac, and its under, inner, and outer part, is surrounded by the obturator ligament. The base of the

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(*a*) Above cited, pl. xxiii.

(*b*) Above cited, p. 272.

(*c*) Supplement, above cited, p. 150.

rupture is between the *m. pectineus* and *adductor brevis*, or between the front heads of the *adductor*. The obturator vessels are upon its inner hinder part, and large branches of the obturator nerve are before it. Differences however may occur, especially if the obturator and epigastric arteries arise in common, of which a case was seen by GADERMANN where the artery passed first on the inner, and then on the front of the hernial sac. This rupture is at first very apparent, if a large quantity of intestine be protruded. It may have a different form, because it penetrates through different interspaces of the muscles. It occurs more commonly in females than in males, and may contain intestines, *omentum*, and even the urinary bladder; and not rarely does it occur at the same time on both sides.

[CLOQUET says (*a*), that " Ruptures of the subpubic (thyroid) hole are much more frequent than generally supposed, and that they are more commonly met with in women than in men. They have distinctive characters when they have attained a certain bulk; are capable of being operated on, especially in thin persons; and that the bladder may displace itself, through the subpubic hole " (p. 87.) In a case, however, which he has given an account of (*b*), the tumour produced no visible external swelling, although of the size of a small hen's egg ;but it was covered by the *m. pectineus* and *adductor longus*. And in DUVERNEY'S case (*c*), in which there was rupture through both thyroid holes, although each of the swellings was as large as an egg, yet no external tumour was observed. Neither was there any swelling in SMITH'S, of Manchester, case (*d*). It must, therefore, be taken as a rule, that these ruptures are not usually discoverable, although in GARENGEOT'S patient it was; the tumour, which was distant about a finger's breadth from the *pudendum*, descending six inches down on the inner and upper part of the thigh (*e*); it was reduced. LAWRENCE considers that " the *m. pectineus*, the long and middle heads of the *m. triceps*, and the *m. gracilis*, so completely close the space into which the sac protrudes, that they must by their pressure prevent it from increasing to any great bulk." (p. 619.)

FRANTZ relates (*f*) the case of a woman, forty years old, who, with many symptoms of strangulated rupture, had severe pain at the upper inner part of the left thigh, which came on suddenly, and recurred every ten minutes. No swelling was observable, but pressure high up between the *m. triceps* and the adductor muscles produced severe pain. There was neither tenderness nor pain in the belly. Three years previously she had had the same symptoms, but was suddenly relieved, whilst pressing on the part, when something seemed to go back with a noise into the belly. This had occurred more than once since, though less severely. When FRANTZ attended her, the symptoms were much more violent and less manageable; bleeding, purging, pressure, and other means were useless. Stercoraceous vomiting occurred on the ninth day, and the symptoms of strangulation increased up to the fourteenth, when she seemed dying, but a free discharge of stool then took place; and ultimately she recovered.

The only two examples of this disease I know of, are one from a male subject in St. Thomas's Museum, and another in the collection of the Royal College of Surgeons.—J. F. S.]

1246. The *diagnosis* is founded on the seat of swelling at the upper inner part of the thigh, on its peculiarly elastic tension, on the mode of its origin, on the possibility of its reduction, on the sensation of gurgling, or of different kinds of contents in the swelling, and on the gastric symptoms which usually accompany ruptures. This rupture may be strangulated, and the strangulation is usually at the mouth of the sac, but is more rarely caused by the neck of the sac or by the muscles.

1247. If the rupture be reducible, it must be returned to its proper place, and there retained by means of a graduated compress and an inguinal spica bandage, or with an inguinal truss, of which the neck is

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(*a*) Recherches Anatomiques.

(*b*) Journal de CORVISART, above quoted.

(*c*) Mém. de l'Acad. Roy. de Chirurgie, vol. i. p. 711.

(*d*) Lancet, 1829-30, vol. ii. p. 735.

(*e*) Mém. de l'Acad., just cited, p. 708.

(*f*) Allgemeine Medicinische, Central Zeitung, April, 1842.

more lengthened downwards, and the pad comes directly below the transverse branch of the share-bone, at the origin of the *m. pectineus.* If there be strangulation, if the remedies employed be ineffectual, and the operation be indicated, the enlargement of the stricture, when possible, must be effected in the bloodless way, with the blunt hook from within outwards, and downwards. The dilatation with the knife, if necessary, must, according to ASTLEY COOPER, be made inwards.

If the rupture be concealed beneath the muscles, the *diagnosis* is rarely so certain that the operation can be undertaken. According to GADERMANN (*a*), the cut must be made through the skin and femoral ligament, an inch below POUPART'S ligament, and as far from the pubic *symphysis*, and continued rather inwards, about four inches in length; the pubic muscles must be cut through obliquely, and also the long and short heads of the *m. triceps*.

VII.—OF VAGINAL RUPTURE.

(*Hernia vaginalis*, Lat.; *Scheidenbruch*, Germ.; *Hernie vaginale*, Fr.)

GARENGEOT, above cited, p. 707.

HOIN, above cited, p. 211.

CHRISTIAN, On a species of Vaginal Hernia occurring in Labour; in the Edinburgh Medical and Surgical Journal, vol. ix. p. 281.

STARK, Dissert. de herniâ vaginali et stricturâ uteri. Jena, 1796.

COOPER ASTLEY, above cited, part ii. p. 56.

1248. In *Vaginal Rupture* the intestines pass down in the fold of the *peritoneum* between the womb and the *rectum*, or between the former and the bladder, in consequence of which a swelling takes place on the hinder or front wall of the *vagina*, but for the most part more on one than on the other side, which, as it enlarges, passes between the *labia*, and attains considerable size. The rupture usually coutains the urinary bladder when it is on the front wall of the *vagina*, or the womb when it is on its back wall. There may be also a portion of the small intestine, more rarely of the *colon* or of the *omentum*. The swelling is elastic, and free from pain; when pressed it recedes, but recurs on coughing, and so on; it increases in the upright, and diminishes in the supine posture. The mouth of the womb is completely free. If the swelling occur at the hind wall of the *vagina*, it is generally deeper than in front; in the latter case it is also usually accompanied with great inconvenience, in consequence of displacement of the bladder. With a large rupture at the hinder wall of the *vagina* there is most commonly prolapse of the *anus*. If the rupture be caused hastily, by violent straining and the like, the patient feels as if something were torn in the *vagina*, and severe pain, which subsequently is converted into a remitting colicky pain. If the vaginal rupture contain the bladder, it causes great disposition to make water, itching in the *urethra*, retention of urine, tension and painful distension of the belly, sometimes agitation, restlessness, dragging at the stomach, and sundry disturbances of the nervous system. In the protruded part of the bladder a stone may be formed.

1249. The predisposing causes of vaginal rupture are, relaxation of the *vagina* from previous delivery; whites, improper use of *coitus*, warm bathing, fire-pans, relaxed state of the body, inclination of the *pelvis* backwards, so that the intestines sink more deeply into it, and also wide *pelvis*. This rupture generally occurs soon after delivery, from straining; it rarely happens in unmarried women.

(*a*) Above cited, p. 29.

1250. The replacement of vaginal rupture is usually easy. The patient being placed on her back, pressure is made with the fingers upon the swelling, and continued, if it return upwards with the fingers, even to the entrance of the womb. If the reduction be difficult it should be favoured by relaxing clysters, and by continuing the supine posture. The reprotrusion of the rupture is best prevented by a cylindrical pessary, which can be fixed with a T bandage. The patient must avoid all straining, and if the rupture protrude in spite of the pessary, that instrument must be removed, and after the reduction of the rupture, replaced. A radical cure may perhaps in many cases be effected by the continued use of the pessary and of astringent injections into the *vagina.* If this rupture protrude during childbirth, it must be kept back by continued pressure, till the child's head have descended, and then delivery is quickly completed. Vaginal rupture may be strangulated (although rarely, on account of the yieldingness of the parts surrounding the rupture) by the enlarged womb during pregnancy, or by the collection of fæcal matter. The return is effected by the use of suitable means, at least no case is known in which the operation was necessary, which also is only possible when the rupture is low down in the *vagina.*

The midwife Rondel (*a*) recommends a ring-pessary of watch-spring and Indian rubber for keeping up this rupture.

VIII.—OF PERINÆAL RUPTURE.

(*Hernia Perinæi*, Lat.; *Mittefleischbruch*, Germ.; *Hernie du Périnée*, Fr.)

1251. *Perinæal Rupture* occurs by the descent of the intestines between the *rectum* and *vagina* in women, and between the *rectum* and bladder in men. The external swelling in the *perinæum* is different; it presents itself in the male generally in the region of the neck of the bladder; in women between the *vagina* and *anus*, usually on one or other side, and at the bottom of the *labium.* This rupture may contain a part of the intestinal canal, of the *omentum* or of the bladder. In women it must always be complicated with vaginal rupture (1). In men it causes various urinary inconveniences.

(1) Chopart and Desault (*b*) believe that perinæal rupture in women is not possible, as a vaginal rupture is more easily formed. Its existence in women has, however, been proved by the observations of Mery (*c*), Curade (*d*), Smellie (*e*), and Schreger (*f*); and many examples of it have been given by Chardenon (*g*), Pipelet (*h*), Bromfield (*i*), Schneider, Scarpa (*k*), Jacobson (*l*), and Schott (*m*); also A. Cooper (*n*).

1252. Perinæal rupture is rare, and only possible in violent driving of the intestines downwards; in great resistance of the coverings of the belly, great relaxation of the peritoneal fold between the *vagina* and *rectum*, or between the *rectum* and bladder, and in slight inclination of the *pelvis.* Perinæal rupture which contains the bladder, occurs especially in pregnancy, when the bladder is thrust downwards and outwards by the

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(*a*) Mémoire sur la Cystocèle vaginale, et sur les meilleurs moyens d'y remédier. Paris, 1835.

(*b*) Traité des Maladies Chirurgicales, p. 292.

(*c*) Mémoires de l'Acad. de Chirurgie, vol. ii. p. 25.

(*d*) Mémoires de l'Acad. des Sciences, 1713.

(*e*) Sammlung besonderer Fälle in der Hebammenkunst, vol. ii. pp. 147, 148.

(*f*) Ib., p. 181.

(*g*) Hoin, above cited, p. 135.

(*h*) Mémoires de l'Acad. de Chirurgie, vol. iv. p. 182.

(*i*) Chirurgical Observations, p. 264.

(*k*) Ollivier's Translation, Mémoire sur la Hernie du Périnée; at the end of his Supplement, p. 118.

(*l*) In von Graëfe und Walther's Journal, vol. ix. pt. iii.

(*m*) Nosologisch therapeut. Betrachtung dreier interessanter Krankheitsfälle, above cited, p. 59. Frankfurt, 1827. 8vo.

(*n*) Above cited, p. 59.

distended womb (*a*). In men, perinæal rupture has a round or pear-shaped form; the swelling is in the *perinæum*, on one side of the *anus*, so that the *raphe* is pressed somewhat aside. In women, so long as the rupture remains in the *perinæum*, the swelling is roundish, and bluntly conical-pointed; as it extends into the *labium* it becomes oblong, egg-shaped. Generally perinæal rupture is small, or up to the size of a hen's egg; but it may attain considerable bulk.

1253. The return of this rupture is usually easy, and it may be kept back by a bandage, consisting of a spring surrounding the *pelvis*, from the hinder part of which a curved spring descends, and attached to its extremity a conical pad, which being applied directly upon the seat of the rupture, the latter is kept up by the strength of the spring and by an elastic bandage around the thigh. If this rupture be strangulated, and its reduction by suitable remedies impossible, the operation is neither difficult nor dangerous, as the opening of the hernial sac is almost always external to the bottom of the *pelvis*. After opening the sac, a button-ended bistoury is to be introduced between the intestine and the tough edge of the hernial sac, and the strangulation may be relieved by a slight cut from below upwards, obliquely towards the side (SCARPA.)

The opinion, that by pressing back the external swelling, the rupture cannot be completely reduced, is disproved by SCARPA's observations.

The Pudendal Hernia of ASTLEY COOPER (*b*), the posterior labial rupture of SEILER, is to be considered merely as a variety of the perinæal rupture in women. The intestines descend along the *vagina*, between it and the *m. levator ani*, and form a swelling on the under half of the *labium*. It is distinguished from inguinal rupture, by the upper part of the *labium* and the abdominal ring being quite free. It is felt on introducing the finger into the *vagina*, pressing on the side of that passage, high up.

See SCARPA, above cited, p. 139.

CLOQUET, J.; in Nouv. Journ. de Médecine, vol. i. p. 427.

BOMPARD; in Dictionnaire des Sciences Médicales de Bruxelles, vol. vii. p. 448.

IX.—OF RECTAL RUPTURE.

(*Hernia Intestini recti*, Lat.; *Mastdarmbruch*, Germ.; *Hedrocèle, Archocèle, Hernie du Rectum*, Fr.)

SCHREGER, above cited, p. 136.

1254. In *Rectal Rupture* there is a prolapse of the *rectum*, which contains the portion of protruded intestine. The predisposition to this rupture seems to be slight inclination of the *pelvis*, slight projection of the promontory, and slight curving of the rump-bone.

1255. A rectal rupture may perhaps be inferred, firstly, from the long continuance of the prolapse and its size; secondly, especially if the position of the body show slight inclination of the *pelvis*; thirdly, if the flatness of the upper part of the belly indicate an unnatural deepness of the small intestines; and fourthly, if the swelling of the prolapse be upon the one side of greater size, and at the same time, firmer, more elastic and fuller, than on the other. The *diagnosis* is determinable only by examination; the attempt to return the prolapse gives opportunity for seeing whether there be any motion of the contents, whether, in coughing and so on, the swelling reprotrude; whether the patient experience any colic in the prolapse. These experiments may be without satisfactory result, if there be adhesions in the rupture. An old prolapse of the *rectum*,

(*a*) KOSCH, Dissert. de Cystocele perinæali. Regiomont, 1826.

(*b*) Above cited, p 52.

in which there is thickening, enlargement, and so on, has great resemblance to such adherent rupture. Rectal rupture may inflame; there may be even strangulation, by the contraction of the sphincter muscle.

1256. The *treatment* consists in the return of the rupture, and when this is done, in preventing its reprolapse, as will be mentioned in speaking of the rectal prolapse. If the replacement be impossible, the case must be treated as a prolapse of the *rectum*.

X.—OF PHRENIC RUPTURE.

(*Hernia phrenica*, Lat.; *Zwerchfellbruch*, Germ.; *Hernie diaphragmatique*, Fr.)

[Protrusions through the *diaphragm* occur in different ways.

First, Through the natural apertures by which the *aorta*, *vena cava inferior*, *œsophagus* and intercostal nerves pass. These are very rare, and ASTLEY COOPER says he has never seen an instance. MORGAGNI mentions one, in which the *omentum*, the *duodenum*, and *jejunum*, with part of the *ileum*, ascended by the side of the *œsophagus*, and compressed the heart and lungs into a very small compass (*a*); also another, in which part of the *colon*, a large portion of the *omentum* and the *pancreas* passed through the hole for the intercostal nerve. FANTONI also mentions a case, in which the stomach and part of the *omentum* had entered the chest by the side of the *œsophagus* (*b*).

Second, From malformation of the *diaphragm*, which is more frequent, and is more common on the left than on the right side, and in the muscular than in the tendinous portion of the muscle (1). MACAULAY mentions one case, in which the stomach and greatest part of the *pancreas* had passed into the cavity of the left *pleura*; and another, in which the whole liver had entered the right *pleura* (*c*). If the protrusion and the aperture be considerable, the child dies soon after birth. But if the aperture be small, the patient may live for some years; and in the case mentioned by ASTLEY COOPER (*d*), the following symptoms were observed. Oppression in breathing from childhood; and as she increased in years the least hurry in exercise, or exertion of strength, produced pain in the left side, a frequent cough, and very laborious respiration. After great exertion an attack of pain in the upper part of the *abdomen*, with vomiting, and a sensation of something dragging to the right side, and always referred to the stomach. The cessation of these symptoms was as sudden as their accession; after suffering severely for a short time all pain and sickness ceased. These symptoms were of longer continuance as she became older. At twenty-eight years she died, having had symptoms of strangulated rupture for some days before. *On examination*, eleven inches of the great arch of the *colon* was found to have passed through a hole, two inches in diameter, in the left side of the *diaphragm* into the chest, together with a considerable portion of *omentum* (2). These cases generally are unprovided with any hernial sac, the *peritoneum* and *pleura* both seeming to terminate at the margin of the hole. COOPER, however, relates a case, in which there was a sac considerably larger than a tennis-ball in the right side of the chest, consisting of the *pleura* and *peritoneum* united, with its orifice at a small distance from the right side of the ensiform cartilage, where there appeared a deficiency of

(*a*) Epist. liv. art. xiii.

(*b*) De Observ. Med. et Anat. Epist. 1714. Epist. xxiii.

(*c*) Medical Observations and Enquiries, vol. i. p. 25.

(*d*) Medical Records and Researches.

fibres in the large muscle of the *diaphragm*. The sac contained the right extremity of the stomach and beginning of the *duodenum*, the arch of the *colon*, and part of the *omentum* (3).

Third, From wounds or laceration of the muscle, which remain during life. This may happen from penetrating wounds with the sword, or by broken ribs being thrust through the *diaphragm*. Sometimes even a blow on the belly, received in a fall, will rupture the tendon of the *diaphragm*. The patient lived five days, and on *examination* the stomach and part of the *duodenum* were found protruded into the left *pleura* (4). (A. Cooper.)

(1) In St. Thomas's Museum there are two specimens of Phrenic Rupture through the left side of the muscular part of the *diaphragm*; in the one small intestines, and in the other part of the stomach has passed into the chest.

(2) This preparation is in the Museum at St. Thomas's. Two other cases are mentioned; one by Clark (*a*), and the other by the younger Monro (*b*).

(3) An instance of protrusion of half the pyloric extremity of the stomach, the whole arch of the *colon* and the *omentum*, through a hole, two inches in diameter, in the left muscular portion of the *diaphragm*, near the *vertebræ*, is mentioned by Leacock (*c*), in a man of forty-nine, who had severe pain of the belly, especially at the pit of the stomach; constant vomiting, with rigors and disposition to syncope on the slightest movement. He died within thirty hours of the symptoms coming on.

(4) A case of aperture through the tendon of the *diaphragm*, by which the stomach, transverse arch of the *colon*, and *omentum* passed into the left side of the chest, is related by Macfadyen (*d*).

XI.—OF MESENTERIC AND MESOCOLIC RUPTURES.

(*Hernia mesenterica et mesocolica*, Lat.)

It might at first sight appear incorrect to describe these as ruptures, because they do not leave the cavity of the belly; but they are as truly ruptures as if they did, inasmuch as they escape from their proper cavity, the reflected *peritoneum*, and are found on its external surface.

The mesentery and mesocolon, each consisting of two layers of *peritoneum*, may have either of these layers naturally deficient, or torn by violence, and thus an opening may be formed, through which the intestines entering, separate the peritoneal layers and form a hernial pouch between them. Astley Cooper says (*e*) that he is unable to determine which of these is the cause of the disease, but is disposed to believe its source is in an originally defective structure. Whether these cases ever present symptoms of strangulation may be questionable. Of the two cases mentioned by A. Cooper, nothing was known, and his presumption of what the symptoms might have been is of little consequence. In the mesenteric rupture, all the small intestines, except the *duodenum*, had passed between the mesentery by a small aperture in its hinder layer. In the mesocolic rupture, the aperture was in the front layer of the mesocolon on the right side, and it contained all the small intestines, except the *duodenum*, a small part of the *jejunum*, and the termination of the *ileum*. Lawrence says (*f*) he has seen an instance of mesocolic rupture in that portion of the mesocolon belonging to the sigmoid flexure of the *colon*; and also refers to Jobert's case (*g*), in which the intestine having passed through Winslow's hole had become strangulated in an opening of the mesocolon.

(*a*) Transactions of a Society for the improvement of Medical and Surgical Knowlege, vol. ii. p. 118.

(*b*) Treatise on Crural Hernia.

(*c*) A. Cooper, above cited, p. 72.

(*d*) Edinb. Med. and Surg. Journ. vol. xix p. 382.

(*e*) Above cited, part ii. p. 73.

(*f*) Above cited, p. 630.

(*g*) Traité des Maladies Chirurgicales, vol. i. p. 522.

It may also be here noticed that LAWRENCE has seen the broad ligament of the wound separated and forming a sac similar to those just mentioned, (p. 630.)

As the disease is necessarily fatal, it has been proposed to open the belly near the presumed seat of the obstruction, and if possible ascertain it. This was done, though without success, by DUPUYTREN; but his failure is attributed to his own wishes in the conduct of the operation having been overruled. The examination after death proved however that his proposal was the correct one (*a*).

XII.—STRANGULATION OF INTESTINE WITHIN THE PERITONEAL CAVITY.

The bowels may become strangulated within the peritoneal cavity, according to ASTLEY COOPER (*b*), by passing through apertures in both layers of the *omentum*, mesentery or mesocolon; by adhesions consequent on inflammation leaving an aperture in which a portion of intestine becomes confined; and by a membranous band forming at the mouth of the hernial sac, lengthening by the repeated protrusion and return of the intestine, and at last accidentally entangling and confining it. To these may also be added the adhesion of the *omentum* to the bottom of the hernial sac, which sometimes becoming tense, presses the bowel passing behind between itself and the hind wall of the belly, and preventing the passage of its contents, produces strangulation. Of the two latter forms notice has already been taken (*par.* 1171 and 1177, *note* 1) as being connected with the ordinary descent of ruptures.

LAWRENCE observes (*c*), "the violence of the symptoms and their rate of progress vary very much in different instances. They sometimes come on gradually, and advance very slowly, the case appearing to be one of mechanical obstruction, and being attended with an almost indolent enlargement of the *abdomen*. In other instances the close pressure of the stricture excites active *peritonitis* and *enteritis;* the inflammatory symptoms are strongly marked, and the case proceeds rapidly to a fatal termination. As the exciting cause of the mischief is not indicated in these cases by any characteristic symptoms, they are considered and treated as examples of ordinary *peritonitis* and *enteritis*. The real nature of the malady is not suspected until it has lasted for some time, and more especially from the combination of obstinate constipation with fæcal vomiting. * * * The disease if left to itself is inevitably fatal," (p. 630).

The subject of Internal Strangulation has occupied the attention of ROKITANSKY of Vienna, and he has divided it (*d*) into three species. *First.* The narrowing or complete obliteration of the canal of a piece of intestine, resulting from the pressure exerted on it at one or more spots, by a smaller or larger portion of intestine or its mesentery, so as to compress it against the opposite side of the *abdomen*. *Second.* The rotatory species, which consists of the rotation of one part round an axis formed by some other part; it includes three subspecies; *a*, the rotation of a portion of intestine round its own axis; *b*, round an axis formed of the mesentery; *c*, where a portion of intestine forms the axis round which another larger portion with its mesentery turns, so as to touch the periphery of the axis at every point. *Third.* This is caused by some peculiar arrangement of parts, the result of original malformation, or of previous disease. These strangulations of the intestine occur in circular or fissured spaces formed, *a*, by fibres or bands of cellular membrane running from one organ to another; *b*, by adhesion of the free end of the vermiform appendix to some spot of the walls of the *abdomen*, or to a portion of intestine

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(*a*) JOBERT, p. 581.

(*b*) Above cited, p. 75.

(*c*) Above cited.

(*d*) Medicinische Jahrbücher des Oesterv. St., vol. xix. 1836.—Also in British and Foreign Medical Review, vol. iii. p. 495. 1837.

or mesentery; *c*, by adherent *diverticula*; *d*, by the adhesion of two convolutions at a single point; *e*, by perforations in the mesentery, or by fissures in an *omentum* altered by disease.

The conclusions which ROKITANSKY draws from the numerous cases with which his paper is illustrated are, *First*, That though no age precludes the possible occurrence of internal strangulations of the intestines, yet they are most frequent in the middle and advanced periods of life. *Second*, That for a longer or shorter period before the fatal termination, the patient is attacked by symptoms indicating a strangulation of the intestine. These generally commencing with a sudden cutting pain in the bowels (in some cases proceeding from a determinate point) followed by more or less rapid visible distension of the belly, tympany, constriction of the chest, anxiety, *nausea*, and vomiting, according to the violence and duration of the strangulation, sluggish bowels and long continued costiveness occur, with or without the previous symptoms. Rest, gentle aperients, and favourable positions of the body, mitigate or dissipate these symptoms, but they recur from the original cause, and terminate fatally. *Third*. The course of the affection is not generally very rapid; it seldom destroys the patient before the second day, and frequently runs on for six, eight, or ten days; rarely extends to the third week, and is then interrupted by remissions and seeming improvements. *Fourth*. The disease may be distinguished mostly by the appearance of the patient; by the succeeding attacks; their origin from a determinate cause, and their course; by the intervals of ease between the attacks; by their suddenness and progressive increase after a certain period; and finally, by insurmountable costiveness. ROKITANSKY rejects all medicine, especially purgatives, and proposes the knife as the only means of relief.—J. F. S.]

II.—OF RUPTURES OF THE CHEST.

CHAUSSIER; in Journal de Médecine, par LEROUX. March, 1814.
VERGNE, sur les Hernies des Poumons. Paris, 1825.

1257. *Ruptures of the Chest* are very rare, and no other part than the lungs can easily be contained in them (*Hernia Pulmonum*, Lat.; *Lungenbruch*, Germ.; *Hernie des Poumons*, Fr.) They are either congenital, and resulting from imperfect development of the walls of the chest, or they occur subsequently, by destruction of the walls of the chest, without wound of the general covering; for instance, by extensive fractures of the ribs, by tearing of the intercostal muscles, by severe cough (1), by destruction of the ribs, and so on. After such injuries, the lungs, on account of great extent and mobility, more frequently form ruptures, if they are not adherent to the surrounding parts (2).

[(1) GRATELUP (*a*) describes a protrusion of the lung between the sixth and seventh rib on the left side, which occurred during coughing. The swelling was soft and elastic, an inch and a half long, and three quarters of an inch wide, and was painful at every inspiration. GRATELUP returned it, and applied a pad with a bandage, after which the patient had no more inconvenience, and recovered.

(2) RICHTER says, that "SABATIER told him of a soldier who at the battle of Rosbach was wounded in the chest. The corresponding portions of two ribs which had been shattered by the ball were lost. The opening however closed, but the broad soft scar soon yielded after the cure, and formed a bag which at every breathing alternately sunk and rose again." (p. 4, 5.)]

1258. If a pulmonary rupture occur after any of the just-mentioned occasional causes, a soft elastic swelling is produced, which gradually enlarges, often brings on a painful dragging, which ceases when the swelling is returned. Its enlargement corresponds with the movements of the chest in respiration.

1259. Such rupture may be easily kept back, by means of pressure, but no radical cure is to be hoped for, because the disease is grounded in a solution of continuity of the ribs or intercostal muscles, which cannot be restored.

(*a*) RICHTER's Abhandlung von Bruchen. Edition 1785.

[As the lungs are occasionally found out of their proper cavity in consequence of deficient formation of the chest and other causes, so is also the heart; and this condition, whether it be simply unnatural position within the chest itself, or actual removal from it in a greater or less degree, is called *displacement of the heart (Ectopia Cordis*, Lat.*)*. When the congenital displacement is *within* the chest, the heart may be situated either, *a*, horizontally, which is very rare; *b*, vertically in the centre of the chest, as quoted by Breschet (*a*); *c*, vertically with its apex upwards and between the lungs, and its base with the large vessels as low as the navel, as in De Torres' case (*b*); or *d*, the heart may be more or less to the right side, and its apex pointed in the same direction, or it may be placed completely on the right side, with or without transposition of the *viscera* of the belly, as in Breschet's four cases (*c*). Similar examples have also been noticed by other writers.

When the heart is congenitally displaced *without* the chest, it may be either on the surface of the body, or beneath the skin. Of the former kind Breschet speaks of cases "connected with deficiency in the *diaphragm* and abdominal muscles, in which the heart, liver, and stomach, sometimes also the lungs and all the abdominal *viscera* are contained in a sac, sometimes covered only by *peritoneum*, sometimes by an extension of the common integuments, and sometimes occupying the sheath of the umbilical cord, forming a variety of umbilical rupture." (p. 25.) O'Bryen has also given an account (*d*) of partial displacement of the heart, consequent on absence of the ensiform cartilage, and part of the *recti* muscles and *diaphragm*, in which a portion of *pericardium*, containing the tip of the left ventricle, preternaturally lengthened, protruded, together with part of the arch of the *colon* immediately beneath the integument. The child lived three months, and the heart appeared to be insensible to the touch. Or the protrusion may depend on fissure, or deficiency in the ribs or breast-bone. Of the *latter* kind of displacement Ramel (*e*) mentions a case in a girl of ten years, in whom the heart was placed below the *diaphragm* in the situation of the stomach. Deschamps (*f*) relates the case of an old soldier, in whom the heart was found in place of the left kidney. Breschet gives an account of three cases in which the heart was found in the neck.

Displacement of the heart *after* birth may occur at any period, most commonly by various kinds of diseases; but Stokes has related (*g*) a "case of probable dislocation of the heart from external violence," in which the person having been crushed between a water-wheel and the embankment supporting it, had two of the lower ribs on the left side, the fifth, sixth, and seventh on the right side, and the right clavicle and *humerus* broken. For the first three hours he was completely insensible. He afterwards felt great pain in the right side of the chest, with a sensation as if a foreign body preventing respiration had been introduced into the right lung; the pain was accompanied with violent throbbing and heaving, and it was soon discovered that his heart was pulsating at the right side of the *sternum*. The person himself is quite positive that before the accident his heart beat on the left side, and was the first to notice its altered position. He recovered, and was subsequently able to follow his usual habits of hunting and shooting.

Actual protrusion of the heart (*Hernia Cordis*, Lat.; *Herzbruch*, Germ.; *Hernie du Cœur*, ou *Cardiocèle*, Fr.) is very rare, even congenitally. Chaussier gives the account of one case, a female infant in whom there was a soft roundish swelling about an inch high, and two and a quarter inches broad at the upper and fore-part of the belly, in which, on the slightest inspection, the form and various movements of the heart and the dilatation and contraction of its ventricles were observed. Its size varied according to the different states of respiration; when the child inspired, the heart rose and seemed partially retracted into the chest, but when she expired the heart was driven forwards and downwards and the motions of the ventricles were very manifest. The swelling gradually increased in bulk, and enlarged when the child cried, especially when she was held upright; but it became softer and smaller when she was quiet and laid down. Gentle pressure also diminished the size of the swelling. As far as could be ascertained there was a large opening on the left side of the chest, below the edge of the fourth rib; some of the ribs below were deficient at the aperture. The child was well and healthy. Chaussier also mentions the case of a soldier, twenty-seven years old, in whom all the breast bone was deficient below the first pair of ribs. The five

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(*a*) Sur l'Ectopie du Cœur; in Repert. Génér. d'Anatomie et de Physiologie Pathologiques, &c., vol. ii., p. 9. Paris, 1826. 4to.

(*b*) Philos. Trans., vol. xli. p. 776, 1741

(*c*) Mémoire sur l'Ectopie du Cœur; in Repertoire Général d'Anatomie.

(*d*) Transact. of Provinc. Med. and Surg. Assoc., vol. vi. p. 374.

(*e*) Journal de Médecine, vol. xlix., p. 423.

(*f*) Journal Génér. de Méd., vol. xxvi. p. 275.

(*g*) Edinburgh Medical and Surgical Journal, vol. xxxvi. p. 44.

following pairs of ribs had no cartilages, but the seventh pair had cartilages, and united with each other at the mesial line. The interspace thus left on the front of the chest was large oblong, and seemed covered only by skin, and all the movements of the heart could be perceived through it: but there was not any protrusion. The man was perfectly healthy, had served several years, and sustained the ordinary fatigues of a soldier's life (*a*).]

III.—Of Ruptures of the Brain.

Corvinus, Dissert. de herniâ cerebri. Argent., 1749.

Siebold, C., Collectio observationum medico-chirurgicarum. Fasc. i. art. i. De hernia cerebri. Würzeb., 1769.

Ferrand, Mémoire sur l'Encephalocèle; in Mémoires de l'Académie de Chirurgie, vol. ii. p. 61.

Oehme, Dissert. de morbis recens natorum chirurgicis. Lips., 1773.

Held, Dissert. de herniâ cerebri. Giess., 1777. 4to.

Sallneuve, Dissert. de herniâ cerebri. Götting., 1792. 8vo.

Niemeyr, De herniâ congenitâ. Halæ, 1833.

Thiemig, Dissert. de herniâ cerebri. Götting., 1792. 8vo.

Earle, Henry, in Med.-Chir. Trans., vol. vii. p. 427.

Lipschitz, Encephaloceles acquisitæ cum abscessu cerebri observ. Regimontii, 1828.

Otto, A. W., Lehrbuch der pathologischen Anatomie, vol. i. Berlin, 1830.

Beck; in Busch, von Graefe und and. Encyclopädisches Wörterbuch, vol. xvi. p. 169, 1837, Article *Hernia Cerebri* (*b*).

1260. *Cerebral Rupture (Hernia Cerebri*, Lat.; *Hirnbruch*, Germ.; *Hernie du Cerveau*, *Encephalocèle*, Fr.) is a swelling, depending on the protrusion of the brain through an opening in the bones of the skull, and overspread by the external coverings. It is either *congenital*, or *may arise accidentally after birth*; in the former case, the brain protrudes through some place corresponding to the sutures; in the latter, through an opening caused by loss of substance.

[The definition just given of this ailment, which is the true one, shows that the term *hernia cerebri*, as used by English Surgeons, is most improperly employed, inasmuch as the disease which they so name has no resemblance to a rupture or protrusion of the brain from its proper cavity and enveloped in its natural coverings, but is consequent on a tearing through of its investing membranes, and a luxuriant granulating process of the brain itself, for the repair of a direct injury, resulting from external violence, by which that organ has been wounded; or to fill up the deficiency which the ulceration excited by irritation and subsequent suppuration, consequent on inflammation and ulceration of the *dura mater*, set up by *necrosis* of the neighbouring skull-bone, has produced. The *hernia cerebri* of British Surgeons, upon which the best paper is that of Stanley (*c*), is, in fact, no brain-rupture at all; it is merely a luxuriant, or so-called "fungous" growth of a brain-ulcer to fill up its cavity, and is nothing more than a neglected active healing ulcer, of which the attempts for its self-cure being too vigorous, assume effectually an unnatural condition, and thus prevent the reparation of the injury they were intended to cure. This state of the brain has been already noticed (*par.* 450, vol. i. p. 425); and it must not be confused with that now under consideration, of which a very excellent account has been given by Beck (*d*); nor with the blood-swellings of the heads of newly-born children, which will be noticed hereafter.—J. F. S.]

(*a*) I have extracted these cases from Hufeland und Harles' Neues Journal der praktischen Arzneikunde, &c., who quote them from a paper of Chaussier's in Leroux's Journal de Médecine, March, 1814; but I cannot find it there, or in the neighbouring volumes.—J. F. S.

(*b*) I have freely availed myself of this excellent article, which is the best I have met with on a subject little attended to in this country.—J. F. S.

(*c*) Cases of Hernia Cerebri, with Observations; in Med.-Chir. Trans., vol. viii. p. 12.

(*d*) Above cited.

1261. *Congenital Cerebral Rupture* is the consequence of an incomplete or retarded formation of the skull-bones, the interspace being filled only by fibrous membrane, through which the brain, when in a diseased state of expansion, as in *hydrocephalus*, protrudes (1). It occurs most commonly in the middle of the occipital bone, in the region of the great occipital hole, or at the posterior fontanel ; it may be, however, at any other part of the skull, where the bones are still separate. It is characterized by a swelling of various size, covered by the integuments of the skull, which are thinned on the top of the swelling and deprived of hair. The aperture, by which the brain protrudes, is irregular, and the swelling, usually fluctuating, can rarely be much diminished by pressure, and recurs when left alone ; the edge of the bone is felt at its base, and the swelling has usually some pulsation. The symptoms vary according to the size of the rupture ; if it be small, there is generally no particular disturbance, when the swelling is properly protected from external violence. In large cerebral ruptures, there arises from the weight of the swelling, tearing of the brain, and so on, pain which the child shows by slight moans and sighs, and which may be relieved by proper support and covering of the tumour. Children, with large cerebral ruptures, commonly die early, and pass their short life in continual stupefaction ; are often sick, badly nourished, and are frequently convulsed. The swelling may inflame and burst, and the patient then soon dies. Several cerebral ruptures may exist at once. Those affected with cerebral rupture often live long, and frequently, without any disturbance of the bodily or mental powers being thereby caused.

Held (*a*) saw a cerebral rupture, in a girl of twenty years ; Guyenot (*b*), in a man of thirty ; Richter (*c*), in a man of sixty ; Lallemand (*d*), in an imbecile girl of twenty-three years ; Wedemeier (*e*,) in a young man of eighteen, who was small, imbecile, and almost speechless.

On examination of congenital cerebral rupture, the *galea aponeurotica* and *dura mater*, are found tolerably united together beneath the external skin. In the sac formed by them is a large or small portion of brain, covered by the *tunica arachnoidea* and *pia mater* ; the entire surface is moistened with serous vapour ; and frequently there is a considerable quantity of serous fluid. No adhesions have been hitherto observed in this rupture. The condition of the displaced brain is similar to that within the skull, but surrounded at its base with a groove. A part of the ventricle, expanded with water, may be contained in the rupture. Not unfrequently is cerebral rupture accompanied with *spina bifida*.

[(1) Otto observes (*f*) on this point, that it (*Watery Rupture of the Brain* ; *Hirnwasserbruch*, Germ. ; *Hydrocephalocèle*, Fr.) " seems to depend rather on a diseased partial enlargement of the brain, which, if not in all, certainly in the greater number of instances, depends on *hydrocephalus*, rather than on deficient development of the skull-bones, which seems only to be consequent on that condition." (p. 409.) And " although in some cases, perhaps, a simple hypertrophy of the brain may cause cerebral rupture, yet *hydrocephalus* is usually its cause ; therefore almost all the well-observed cases of cerebral rupture have distinctly shown this ; and I have also noticed it in the cases which I have observed. In Penada's case (*g*) much water constantly trickled from the cerebral rupture ; and in Earle's case (*h*) the water again collected after having been drawn off. Baron (*i*) has related an instance of a female child who was born with a remarkably large head, which at the end of a month measured twenty-nine inches in circumference. " The circumference did not further enlarge, but a swelling began on the top of the head, over the posterior fontanelle, which, in the space of

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(*a*) Above cited.

(*b*) Ferrand, above cited.

(*c*) Comment. Soc. Goetting, vol. xv. p. 21.

(*d*) Boyer, Traité des Maladies Chirurgicales, vol. v. p. 201.

(*e*) Von Graefe und von Walther's Journal, vol. ix. p. 126.

(*f*) Above cited.

(*g*) Saggio d' Osservazioni e Memorie, vol. i. p. 15. Padova, 1793. 8vo.

(*h*) Medic. Chir. Trans., vol. vii. p. 427.

(*i*) History of a case of Rupture of the Brain, and its Membranes, arising from the accumulation of fluid in a case of Hydrocephalus Internus; in Med.-Chir. Trans., vol. viii. p. 51.

another week acquired the magnitude of a goose's egg. At this period of the disease the mother, on going one morning to take up the child, was very much surprised to find that the swelling had become much smaller, and perfectly soft. She observed likewise a constant dribbling of water from the urinary passages, and that the bed was soaked with the discharge. It continued incessantly for three days and three nights. By this time the swelling had entirely disappeared, the head was considerably smaller, and the integuments which before were very much distended, now fell in large wrinkles over the child's forehead, so as actually to cover the eyes." (pp. 51, 2.) After two months the discharge by the urinary organs diminished, the head acquired greater size than before, "having on this occasion extended itself over the whole of the head and face. * * * A watery discharge, tinged with blood, was seen to ooze from the nostrils and mouth. It continued without ceasing for three days, when the swelling on the top of the head had vanished, and the head itself was much smaller. The fluid never again accumulated in the sack on the outside of the head, nor did the head ever gain its former magnitude, because the discharge from the nostrils was kept up, with slight intermission, till the time of its death," (p. 52, 3,) which occurred about eleven months after. BARON observes in explanation, that "the expansion of the brain, its membranes, and of the *cranium*, seems to have gone on till the parts would stretch no longer, when the rupture took place which caused the first swelling and established a free and large communication between it and the interior of the brain." (p. 55.)

In very rare cases the fluid is contained between the brain and its membranes, and protruding, the latter forms its only contents as in TEXTOR's (*a*) and THOMPSON's (*b*) cases.

Sometimes a portion of the *cerebrum*, sometimes a part of the *cerebellum* is contained in these ruptures, and an instance is given in which the whole *cerebellum* was found in a rupture through the occipital bone (*c*). There is also usually fluid, on which account the disease has been named *hydroencephalocèle.*

Congenital cerebral rupture is considered by MECKEL (*d*) to arise either from collection of fluid in the brain, or on its surface, in which case a portion of the brain and its membranes are protruded. And as to its more frequent occurrence on the occipital bone than elsewhere, OTTO says, that this happens because "the occipital bone consists of several pieces of bone, which only at a more advanced period unite, and that the water collected in the posterior horn of the ventricle can act more powerfully upon the four pits formed by the *dura mater* in the occipital bone than upon the other parts, which rather form an inclined plane." (p. 412.) And he says, that in this case "the brain penetrates through the enlarged occipital hole, and the cleft upper *vertebræ* of the neck, or through special holes in the shell of the occipital bone, or at its upper angle." (p. 410.) Among the more rare positions of this rupture must be mentioned the cases mentioned by MOREAU (*e*) and RICHTER (*f*) in which the swelling appeared at the root of the nose and still more rarely where it protrudes into the orbit, the nostril, and the sphenoidal sinus.

These swellings sometimes are much larger than the head itself, of which a case has been recently mentioned by FORGEMOL (*g*); in this instance the circumference of the head above the ears was only 26 centimètres, whilst that of the tumour was 30 centimètres.

Congenital cerebral rupture sometimes appears to be double, either in consequence of the little yielding of the falciform process of the *dura mater*, and of the longitudinal sinus; or by a tendinous band dividing it into two halves, as in WEPFER's case (*h*), which lived till six years old. These, however, must not be confounded with the actual duplicity of the hernial tumour, "twice noticed" by OTTO "at its commencement in one case, and perfectly formed in the other, where the one was again divided into two halves. And in BILLARD's case (*i*) the scar above the hernial rupture appeared to have been a second rupture."

The cure of these ruptures has been denied, but OTTO cites two instances, BILLARD's, just noticed, and one of MECKEL's (*j*), in which it occurred; "scarred spots being

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(*a*) Neue Chiron., vol. i. p. 469.

(*b*) London Medical Repository, vol. ii. p. 353. 182[illegible].

(*c*) KOLBMANN in SIEBOLD's Journal für die Geburtshulfe, vol. iv. p. 150. 1823.

(*d*) Handbuch der Pathologischen Anatomie, vol. i. p. 301. Leipzig, 1812. 8vo.

(*e*) Dictionnaire de Médecine, vol. viii. p. 51.

(*f*) Comment. Soc. Götting, vol. xv. p. 29. 1804

(*g*) Bulletin de l'Acad. Roy. de Médecine, vol. x. p. 1024. 1845.

(*h*) Obs. de Affect.Capit., p. 46. Scaphusii, 1717.

(*i*) Traité des Maladies des Enfans nouveaux-nés, &c. Paris, 1828. 8vo.

(*j*) Descript. monstrorum nonnullorum, p. 57. Lips., 1826.

found where in the *fœtus* the water had escaped, and the brain seemed to have fallen together." (p. 412.)]

1262. In *Accidental Cerebral Rupture*, the brain protrudes gradually, by means of its alternating pressure, at the spot where a previous injury of the skull has formed an opening, which is only closed by a cellulo-fibrous substance. As the scar has not the extensibility of the coverings in congenital rupture, so accidental rupture never acquires its size. The swelling always pulsates, increases somewhat during expiration, and lessens somewhat during inspiration. If the swelling can be returned, the edge of the opening in the bone may be felt.

[" The acquired cerebral rupture is," says Beck, " so rarely observed that nothing decided can be mentioned as to its progress. If the case mentioned by Lipsius be considered as *hernia cerebri acquisita*, it may be concluded from it, in reference to other cases, that the danger of this condition depends on the disposition of the brain to ulcerative destruction, formation of abscess, and secondary fungus." (p. 176.)

This, truly, is not saying much, and indeed Chelius's observations are not more to the purpose. I do not know of any instance where, after the filling up of the opening in the skull which has been consequent on the loss of bone, either by the violence itself which has broken it, by the surgical operation which has removed it to relieve the brain from pressure, or by exfoliation, the result of direct injury or constitutional disease locally affecting the skull bone, the protusion of the brain with its cellulo-fibrous covering has taken place. Indeed, when from either of these causes an aperture has been formed in the skull, and the corresponding wound of the soft parts around it has scarred by its edges inosculating, if the term may be permitted, with the exposed *dura mater*, of which the surface first granulating, either itself becomes converted into a thin skin, or is covered with skin shooting from the surrounding scalp; in such cases, instead of any protrusion of the brain and its covering membranes, there is a seeming depression, which, however, is really only correspondent to the thickness of the bone lost, and not an actual dropping into the cavity of the skull of the cellulo-fibrous substance, which fills up the hole left by the deficient bone. The edge of the bony aperture in these cases is almost invariably thin, scaly, and sharp, as if there had been an unsuccessful attempt to convert the cellulo-fibrous substance into bone. The pulsations of the brain are, when the patient is unexcited, sometimes, though not always, distinctly perceptible through this substance for some little time after the scarring has been perfected: but sometimes, even whilst the *dura mater* is granulating, little or no beating of the brain is observable. As, however, the scar becomes older and tougher the pulsation becomes less and less perceptible, and at last entirely ceases. But though such is the case under ordinary circumstances, yet if, from any cause, the patient be agitated and the circulation quickened, the throbbing of the brain against the cellulo-fibrous scar is distinctly visible, and subsides only as the agitation passes off. This I have frequently observed, as every one must, who has seen large apertures in the skull, from whatever cause resulting, scarred over.

The cellulo-fibrous scar has a very smooth and highly polished surface, at first of a reddish colour, but subsequently as white or whiter than the surrounding skin; and more or less small blood-vessels are seen meandering upon it, which often remain after the general vascularity of the scar has diminished, and it has become white. Like all other newly-formed parts, its vitality is not great, and consequently, it not unfrequently ulcerates superficially, heals up slowly, and again and again ulcerates and heals up in like manner. Although tough and resisting, it is not sufficiently stout to protect that part of the brain it covers from pressure; and therefore, if the fingers be applied on it sufficiently firmly, the brain being pressed, its functions are disturbed, and convulsions, with the other ordinary symptoms of compression, are produced. On the other hand, a sudden and large impulse of blood may so increase the bulk of the brain as to drive it against the cellulo-fibrous scar with sufficient force to burst through it. A very remarkable instance of this kind is mentioned by Jamieson (*a*) in a girl of thirteen years, who, having fallen from the roof of a house, " broke and shattered her *cranium* at the place where the sagittal and coronal sutures meet, making a depression of the bone of about four inches in diameter;" for which she was trepanned, and " the depressed pieces of bone being all found separated from the neighbour-

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(*a*) The Brain forced, by coughing, through the cicatrice of a wound of the head, &c.; in Medical Essays and Observations, published by a Society in Edinburgh, vol. ii. p. 217.

ing sound bone, were all brought away, and so left a terrible chasm in the *cranium*." (p. 217.) In three months the integuments were cicatrized, but she continued to wear a plate of lead which had been applied over all the dressings on the fifth day after the accident, for five months, " but then, thinking herself secure, she laid it aside, and continued well seven months more, when the kink-cough, (whooping cough,) then epidemic in the place, seized her, and was so violent one night when she was in bed, that the *cicatrix* in her head was lacerated, and the brain was pushed out at the teguments. Being instantly called for, I found above two ounces of the brain lying on the scalp." (p. 218.) Entire paralysis of the limbs ensued, but she had still the use of her reason and tongue; was much inclined to sleep, had a low depressed pulse, *anxietas cordis*, and involuntary discharge of urine. After continuing in this state for five days, she died; but unfortunately no examination of her body was permitted.—J. F. S.]

1263. Accidental cerebral rupture is distinguished from the so-called fungus of the *dura mater*, by its origin; further, by its usually only occurring in more advanced age, and is preceded by pain, stupor, and the like.

The congenital cerebral rupture may be distinguished from the *blood-swellings* of new-born infants, especially by the latter, in general, being seated on the sides of the head, and being unaccompanied with any symptoms of disturbed cerebral functions; whilst congenital cerebral rupture always arises on the region of the suture. Both *cerebrum* and *cerebellum* may be protruded (*a*), and the greater part of the brain contained in the swelling (*b*).

Trew (*c*), Le Dran (*d*), and others, have described cases of cerebral rupture occupying the right parietal bone, but they are the less to be relied on, as in neither case was there any anatomical examination. The occurrence, however, of cerebral rupture in other parts than the sutures, is proved by anatomical examination (*e*).

Cerebral rupture is distinguished from *watery cysts* on the head of newly-born children, with which it agrees in reference to its seat, and by pressure on it causing cerebral symptoms, by its pulsation and great firmness; the *diagnosis*, however, is difficult when, as frequently, a collection of water occurs with cerebral rupture (*f*).

1264. The *treatment* of congenital and accidental cerebral rupture, consists in returning and retaining the swelling within the skull, for which purpose a sufficient degree of compression is employed by bandages dipped in astringent fluids, or by apparatus of leather, or less suitably, of metal, to such extent, as not to produce any symptoms. Small congenital cerebral ruptures may thus be radically cured, which is not to be expected with those arising from accident (*g*). If the cerebral rupture be large, and the reduction impossible, the swelling must be supported and protected from external pressure. In such cases the puncture of the swelling has been proposed in order to discharge the fluid and lessen the bulk of the swelling. This practice is always very dangerous, although it has been practised with success. The puncture should be made with a fine needle or lancet, and after emptying, the aperture is to be closed to prevent the entrance of air.

(*a*) Lallemand and Baffos; in Richerand, Nosographie Chirurgicale. Fourth Edition, vol. ii. p. 318.—Boyer, above cited.

(*b*) Isenflamm; in Archives Générales de Médecine, vol. iv p. 229.—Gaz. Méd., 1834, p. 667.

(*c*) Sanson; in Sabatier, Médecine Opératoire, vol. iii. p. 409.

(*d*) Commerc. lit. Noric., an 1738, p. 412.

(*e*) Observations de Chirurgie. Paris, 1771, vol. i. obs. i.

(*f*) Hoefling, Zwei Fälle von Hirnbruch; in Casper's Wochenschrift, 1835. No. 23.—Compare also Naëgele, Ueber den angebornen Hirnbruch und die Kopfblutgeschwülste Neugeborner in diagnostischer Hinsicht; in Hufeland's Journal, 1822, May, p. 1.

(*g*) Sallneuve, above cited. — Martini; in Froriep's Notizen, vol. xi. p. 222.

Punctures have been made very frequently with successful result (*a*) (1).

Tying the swelling (Schneider) (*b*), and incision with the view of extirpation, under incorrect *diagnosis* (Lallemand) (*c*), and the removal of part of the protruded brain (Stanley) (*d*) (2), have had fatal results. Opening the swelling has sometimes first discovered the incorrectness of the *diagnosis*, and a dry dressing, with slight pressure, has been employed till the brain has returned, and complete scarring of the hole in the skull (*e*) has taken place.

[(1) Henry Earle mentions (*f*) the case of a female child born with a transparent globular tumour at the back of the head, which in eight days had increased to the size of a billiard-ball; it "appeared to be in its nature similar to the disease termed *spina bifida*, and to consist of an expansion of *dura mater*, containing *serum*, in consequence of a deficiency of bony or other support at this part." He made three punctures with a common needle, and let out three drachms of fluid. The punctures had not healed two days after, and pressure again discharged the same quantity of fluid. Two days after, the punctures had healed, and the sac was again full; it was then pricked with a very fine trocar-made needle and *canula*, and an ounce of *serum* drawn off. Five times after, at intervals of from to two four days the puncture was repeated, and at the last little fluid was evacuated, and the sac, having collapsed, thickened. For sixteen days the case went on well, but then the sac inflamed, patches of skin came away, and a thin *ichor* discharged from the whole surface. Three days after, the tumour was as large as ever, but opaque and very vascular; it was then punctured with a lancet, and half an ounce only of fluid discharged. Twice afterwards, the tumour was again emptied with the lancet; but two days after the last puncture, the surface of the swelling inflamed, and on the day following, the flap of the last opening began to ulcerate, and in two days more extended down to the cavity of the sac by a small aperture, through which the *serum* continued to ooze. Three days after she died, without any symptoms of inflammation or effusion on the brain. Adams mentions a case which was punctured seven times, the skin gradually thickened, the secretion of fluid diminished, but protrusion, probably a small portion of the *cerebellum*, remained. The child recovered.

Puncture is not, however, free from danger. Corvinus mentions a case (*g*) in which the large swelling was opened by Fried, and death ensued. Seiler (*h*) performed this operation, and the child died comatose on the third day. Von Graefe (*i*) punctured with a trochar and *canula*, and left in the latter to allow the escape of the fluid; but the swelling becoming painful, and assuming a dusky colour, it was withdrawn, convulsions ensued, and the child died.

Pitschaft (*k*) relates two cases of suppurating protrusions in children, in which some of the brain oozed out, and which were cured by the application twice a day of linen spread with honey, with large compresses dipped in decoction of oak bark; and the internal exhibition of acorn coffee and cooling diet. The children's intellect was uninjured.

(2) Stanley's cases are improperly introduced here; they were all fungous growths of the brain, soon after the removal of portions of the skull which had been depressed. Two of the boys died and one lived.—J. F. S.]

C.—Of Prolapses.

1265. A *Prolapse* (*Prolapsus*, *Procidentia*, Lat.; *Vorfall*, Germ.; *Chute*, Fr.) is the partial or complete protrusion of an organ out of its cavity, so that it comes into immediate contact with the external air; in which consists the difference between prolapse and rupture.

(*a*) Froriep's Notizen, vol. xxxvi. p. 346.—Compare Gazette Médicale, vol. iv. p. 299.

(*b*) Richter's chirurg. Bibliothek., vol. viii. p. 269.

(*c*) Boyer, above cited.

(*d*) Above cited, p. 24.

(*e*) Richter's chirurg. Bibliothek., vol. iv. p. 566; and Stanley, above cited.

(*f*) Above cited.

(*g*) Above cited, p. 336.

(*h*) Rust's Chirurgie, vol. viii. p. 411.

(*i*) von Graefe und von Walther's Journal, vol. xix. p. 162.

(*k*) Hufeland und Osann's Journal für praktischer Heilk. 1832, Oct., p. 56.

1266. The common causes of prolapse, are tearing or relaxation of the natural attachments, or of the openings, and diseased changes of the organ itself.

1267. As the prolapse of the brain, lungs, and bowels have been already considered with their respective wounds, there remains only to be here considered, *prolapsus of the vagina*, *of the womb*, and *of the rectum.*

I.—OF PROLAPSE OF THE WOMB.

(*Prolapsus Uteri*, *Hysteroptosis*, Lat.; *Vorfall der Gebärmutter*, Germ.; *Chute de la Matrice*, Fr.)

CHOPART, Dissert. de uteri prolapsu. Paris, 1722.

STURM, Dissert. de procidentiâ uteri. Erf., 1744.

SABATIER, Sur les Déplacements de la Matrice et du Vagin; in Mém. de l'Acad. de Chirurg., vol. iii. p. 361.

KLINGE, Commentatio de uteri procidentiâ usuque pessariorum in hoc morbo. Götting., 1790.

FOËHR, Dissert. de procidentiâ uteri. Stuttg., 1793.

BACHMANN, Dissert. de prolapsu uteri. Duisb., 1794.

MEISSNER, Die dislocationen der Gebärmutter und der Mutterscheide von Seiten ihrer Entstehung, ihrer Einflusses, und ihrer Behandlung dargestellt. Leipz., 1821, vol. i.

CRUVEILHIER, J., M.D., Anatomie Pathologique. Paris, 1828. fol.

CLARKE, Sir C. M., Bart., Observations on those Diseases of Females which are attended by Discharges. Part I. Third Edit., 1831. Large 8vo.

BOIVIN, Madame, et DUGÉ's, Maladies de l'Uterus. Paris, 1833; 2 vols. 8vo., and translated by G. O. HEMMING, M.D., as On the Diseases of the Uterus; with Notes. 2 vols. 8vo. London, 1834.

RAMSBOTHAM, F. H., M.D., Lectures on the Morbid Affections of the Puerperal and Pregnant States, the Organic Diseases of the Uterine System, &c.; in London Medical Gazette, vol. xvi. p. 529. 1834–5.

BLUNDELL, JAMES, M.D., Observations on some of the more important Diseases of Women. Edited by CASTLE, T., M.D. London, 1837. 8vo.

WYBRAND HENDRIKST, Descriptio historica atque critica variarum uteri prolapsum curandi methodum. Berol., 1838; with three copper-plates.

RICHTER, A. G., Chirurgische Bibliothek, vol. iii.

ULSAMER, M.D.; in BUSCH, von GRAEFE und AND. Encyclopaedisches Wörterbuch. Article, *Gebärmutter dislocationen*, vol. xiii., p. 557.

Besides the works on Diseases of Women by E. v. SIEBOLD, JÖRG, and others.

1268. *Prolapse of the Womb* designates that displacement of the womb in which it descends more deeply into the *vagina.* According to its greater or less considerable descent, is it called *complete or incomplete prolapse.* It may also be accompanied with *inversion of the womb.*

[" The descent of the womb," says SABATIER, " has three different stages, to which have been given the names *relaxation*, *descent*, and *fall* or *precipitation.* When it is only in its first, or even in its second stage, the womb descends more or less in the *vagina;* a pear-shaped tumour is felt, around which it is easy to carry the point of the finger, and which is pierced at its extremity by a transverse aperture. This tumour is situated higher in relaxation, and lower in descent of the womb. When, on the contrary, the disease has arrived at its third and last stage, the womb is precipitated completely out. It carries with it then the *vagina*, doubled upon itself, and a part of the bladder which is very adherent. Many even of the floating bowels of the lower belly sometimes sink into the kind of *cul-de-sac* formed by the *vagina*, and render the tumour monstrously large." (p. 362.)

To the same effect are BLUNDELL's observations. " There are three varieties," says he, " of this complaint, relaxation, *prolapsus*, and *procidentia.* When the womb protrudes beyond the *os externum*, the disease is called *procidentia ;* when it remains at the outlet, *prolapsus ;* when it scarcely subsides below the brim, it then constitutes what is denominated *relaxation*." (p. 33.) It will be readily perceived that BLUNDELL's *procidentia* is our Author's Complete Prolapse, and that his *prolapsus* and relaxation are included under Incomplete Prolapse.]

1269. In *Incomplete Prolapse of the Womb*, (*Prolapsus Uteri incompletus*,) that organ descends more or less into the *vagina*, and forms a pear-shaped swelling, which protruding only whilst the patient stands, can, on examination, be swept round by the finger, and at its lower part a transverse cleft, the mouth of the womb, is felt (1). Or the womb, with its neck, descends between the external generative organs, in which case the *vagina* is at the same time inverted, and descends with it (2).

The symptoms presented by incomplete prolapse are, dull but constant pain in the rump, loins, and flanks, a weight and pressure in the *vagina*, frequent need of going to stool, often violent urgency, and difficulty in discharging the urine (3). All these symptoms increase if the patient standing long, have exerted herself; and diminish or disappear entirely if she continue for a long time in the horizontal posture. If the neck of the womb have descended between the external generative parts, the movements of the body are hindered, and all great exertion rendered impossible. The irritation which under these circumstances affects the womb, and the other organs of the pelvic cavity, may be participated in by the bowels; and the functions of the alimentary canal are often disturbed (4). At the time of menstruation all these inconveniences increase; it becomes irregular; considerable flooding frequently occurs, and is accompanied with a copious discharge of the whites.

[(1) "Of the descents of the *uterus*, the most common, perhaps the most obscure and the most troublesome, is," says BLUNDELL, "that variety in which the *uterus* descends but a little way, an inch or two into the *pelvis*, technically called *relaxation of the uterus*." The symptoms attending this condition, he observes, often lead the woman, if married, to suppose herself pregnant. If the medical attendant have any doubt of the case, "that doubt is to be set at rest by making a careful examination. If the disease exist, you will observe the upper part of the *vagina* to be very relaxed, and the womb to protrude; and were you to introduce a catheter, you would find there is a tendency to an obstruction and distortion of the *urethra*." (pp. 39, 40.)

(2) The more advanced form of incomplete prolapse BLUNDELL speaks of as "a more frequent disease than *procidentia*, (complete prolapse,) and therefore still more important to be known; in which the womb comes down to the external parts, but not beyond them, and called *prolapsus uteri*." The symptoms, he observes, "are worse at night, because the womb comes down in the evening, the patient having been about all day;" this observation may indeed be also applied to relaxation. "On the whole, I should say," he continues, "that there are few diseases which are better characterized than *prolapsus uteri*" by its symptoms. If examinations be thought necessary, they "are better made in the evening than in the morning, for in the morning the womb is almost always in its place, whereas, in the evening, it is considerably descended, so that the displacement is easily recognised. To this character may be added, first, the laxity of the *vagina*, which, in its upper half, is much more capacious, so that, perhaps you might put a pullett's egg into it there, though the lower part of it may be tenser; secondly, a bearing on the *rectum*, producing irritation; and, thirdly, if you introduce a catheter into the bladder, you will find the passage more or less distorted, the instrument moving about, and perhaps turning round completely by being thrown out of the ordinary line." (p. 37-9.)

(3) The disposition to frequent voidance of the urine may arise either simply from the irritation produced by the displaced womb pressing against the neck of the bladder, or from the pressure preventing the complete emptying of that organ, or from the womb dragging it down and bending the *urethra* upon itself backwards and downwards to a greater or less extent. Upon this point RAMSBOTHAM observes :—"The more vehement the woman's efforts to accomplish the relief of the bladder, the more perfect does the obstruction appear. Nor is this difficult of explanation; because, under these forcible

endeavours, the diaphragm and abdominal muscles both being called into strong action, propel the *uterus* even lower; and in this manner the pressure before existing is increased." (p. 530.)

(4) The irritation of the *rectum* is in either of the two stages now under consideration merely attributable to the pressure of the womb, and not to any dragging.

1270. In *Complete Prolapse, or Falling out of the Womb*, (*Prolapsus Uteri completus*,) the organ projects entirely out of the external parts of generation; the *vagina* is thereby drawn after it and doubled; the organs connected with the womb are entirely dragged out of their place; the intestines sink into the sac produced by the inversion of the *vagina*, and therefore a void is always noticed in the lower part of the belly (1). All the symptoms mentioned in in complete prolapse here exist in a greater degree; voidance of the urine is specially attended with considerable difficulty, and often entirely prevented (2); qualmishness, sickness, spasm in the belly, sometimes fainting, severe febrile symptoms often occur, especially when the prolapse has taken place suddenly. The swelling formed by prolapsed womb has an oblong, nearly cylindrical form (3), terminates below in a narrower part, on which is found a transverse opening, (the mouth of the womb,) from whence during menstruation blood flows, and into which a probe may be introduced not more deeply than two inches (4). The base of the swelling is attached to the inner skin of the *labia*, by which the introduction of the fingers, near the swelling, is prevented. The tumour has at first a reddish colour, and is sensible: but by contact with the air, friction, and the moisture of the urine, and so on, it becomes inflamed; a copious secretion of mucus takes place on its surface, and it becomes gradually insensible, and overspread with a thick skin, like other parts (5). The inflammation may be severe, and run on to ulceration, and even to mortification (*a*).

(1) In reference to the size of the prolapsed womb and *vagina* and the contents of the sac formed by the latter, BLUNDELL observes:—"I have seen several cases in which the *vagina* has been forming a large tumour lying forth between the limbs; this cyst containing not merely the womb, but in part the bladder, the small intestines, the ovaries, and perhaps the *rectum*; for where you have *procidentia*, it very rarely happens that the womb only descends, generally the other *viscera* come with it, in a larger or smaller mass. A case of this kind, if you are incompetent, you may mistake for *polypus*, *inversio uteri*, not to mention a large descent of the bladder only; but when you examine the tumour with care, you will frequently discover, first, that on the surface of the tumour, the *rugæ* of the *vagina* are more or less conspicuous; secondly, that you can introduce a catheter into the tumour, provided the bladder be come down; thirdly, that on passing a finger into the *rectum*, it may perhaps descend into the back of the cyst; lastly and above all, that at the lower part of the cyst, the *os uteri* may be found. Sometimes the *os uteri* is so conspicuous that you can see it at the first glance; but at other times it appears under the form of a very minute aperture, the usual tubercle being wanting." (pp. 33, 4.)

CRUVEILHIER says he has seen one case of prolapse in the living subject in which the bowels descended into the inverted *vagina*, but has never met with it after death. He also observes that in consequence of the peritoneal doubling or pouch between the *vagina* and bladder being much shallower than that between the *vagina* and *rectum*, the *vagina* may be completely inverted in front, whilst it is scarcely ever so behind; and that, consequently, the vertical extent of the swelling is greater before than behind. [This observation seems to me the very contrary of what might be expected.—J. F. S.] For the same reason, he says also, that the front pouch is too slight generally to receive intestines into it, whilst the hind one may receive a large quantity, and that under such circumstances the prolapse may become as large as a man's head (*b*). (This does not appear to me a more satisfactory statement than the former, for did the hinder pouch still remain, the protruded swelling would have the form of a double sac, separated by

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(*a*) HAUSMANN, Dissert. de Uteri Procidentiâ. Viteb. 1728.—SAVIARD, Observ. chirurg. Paris, 1784, p. 58.—SABATIER, above cited, p. 362. FRORIEP's chirurgische Kupfertafeln, Pl. lxi.

(*b*) Livr. xxvi. p. 3.

a cleft, the front one formed by the womb itself, ánd the hind one by the peritoneal sac containing intestines, and thus in fact becoming a vaginal rupture. But this is not the case, at least in the few cases I have seen (as they generally fall to the lot of the man-midwife, rather than the Surgeon); for in them the prolapsed part was smooth and regular, the whole circumference of the *vagina* having been included in the protrusion, and thus forming a common funnel into which the bowels descend.—J. F. S.

"Many months, or even years, may elapse," says CLARKE, "whilst the *uterus* is making this descent; for when the *uterus* has descended so far that it can rest upon the *perinæum*, there it not unfrequently remains, resting upon it as upon a shelf, the violence of the symptoms abating, the parts which suspend the *uterus* above, although much lengthened, being no longer put upon the stretch. From this circumstance it should appear that the greater number of the inconveniences attending this complaint depend less upon the pressure of the *uterus* in the *vagina*, than upon the dragging of the parts above." (p. 68.)

(2) Although difficulty in voiding the urine and frequently even retention are consequent on prolapse of the womb, yet CRUVEILHIER has given (*a*) instances in which incontinence has ensued. And in the case above mentioned, in which the *rectum* was displaced, he states that there was involuntary discharge of the stools.

(3) CLARKE says that "after some time the breadth of the tumour increases, so that it becomes of a globular form." (p. 71.) And further that "the *vagina*, when dragged down by the *uterus*, sometimes undergoes such a degree of distension that its diameter will be greater than that of the *pelvis* itself. In the case of WATKINS, who died in Kensington workhouse, the tumour measured more than fifteen inches in circumference, and its length was six inches and a half." (p. 125.)

(4) CRUVEILHIER confirms BLUNDELL's observation in reference to the altered form of the mouth of the womb, its front lip being sometimes effaced whilst the hind one is very prominent. Its direction also is sometimes changed, the long axis of its aperture being from before backwards, instead of from side to side; and occasionally it is so small as to seem scarcely large enough to permit the escape of the menstrual fluid (*b*).

CRUVEILHIER states (*c*) that he has invariably observed in prolapse of the womb an elongation of that organ, accompanied with great contraction and narrowing, which occurs principally at the junction of the body with the neck. CLOQUET also gives (*d*) an instance of the same kind. CRUVEILHIER further notices (*e*) that sometimes this elongation and at other times the descent of the womb is greatest. In some instances he found the lengthening so great that when seen within the *pelvis*, the womb appeared to occupy its proper position; and under these circumstances he considers that the disease commenced with the inversion of the *vagina*. "The lengthening of the womb," he observes, "can only be effected by previous softening, in consequence of which the organ becomes in some degree ductile; this softening may be perhaps, purely and simply the result of the slight pull upon the womb" (*f*).

(5) RAMSBOTHAM observes:—"It is worthy of remark, however, that although the local inconvenience is much more distressing when the womb protrudes without the *labia* than when it is still retained within the *pelvis*, yet the system in the former case does not suffer so much; and the reason is obvious. While the vaginal membrane is protected from the external air, its secretion is kept up, and sometimes in an extensive degree; but when exposed to the atmospheric influence it ceases to secrete, and a proportionate quantity of power is therefore saved." (p. 531.)

"It seldom happens," remarks CLARKE, "that the *vagina* remains long exposed to the action of the air without ulceration taking place upon its surface. This ulceration does not attack the whole of the exposed surface at once; small spots or patches inflame and ulcerate, and these sometimes run into each other, but the whole surface is seldom covered by them. The ulcerations are generally not deep, and they have the appearance of healthy sores, which readily heal upon the replacement of the prolapsed parts. Whenever ulcerations are met with, the *os uteri* seldom escapes being attacked by one of them." (p. 83.)

Sometimes it happens after displacement of the bladder consequent on prolapse of the womb, that stones form either in the *fundus*, of which CLOQUET mentions (*g*) two instances, and CRUVEILHIER, one; but the latter pathologist has found a stone in that part of the bladder which had not been dragged down (*h*).

Although the *rectum* is less likely to be pulled from its place than the bladder,

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(*a*) Livr. xxvi. p. 3.
(*b*) Ibid.
(*c*) Livr. xvi. p. 2.
(*d*) Pathologie Chirurgicale.
(*e*) Livr. xxvi. p. 2.
(*f*) Livr. xvi. p. 2.
(*g*) Pathologie Chirurgicale.
(*h*) Livr. xxvi. p. 3.

yet this has also happened. Cruveilhier relates (*a*) an instance in which the *rectum*, dilated and filled with stool, was drawn forwards a little above its extremity, and formed a funnel-like lengthening. And Cloquet figures (*b*) a case in which, with great enlargement of the *rectum*, a considerable finger-like process descended into the cavity of the inverted *vagina*.]

1271. The *Causes* of prolapse of the womb are predisposing and occasional. The former consist in relaxation of the natural attachments of the womb by copious, long-continued flow of *mucus*, by frequent deliveries, specially if they be very quick, or difficult, and require artificial aid (1). The occasional causes are severe exertion, by which the abdominal muscles are violently contracted, raising heavy weights, violent pressure in going to stool, long-continued standing, and so on. They cause the prolapse the sooner they operate after delivery; and therefore the disease occurs most commonly in women of the lower classes who have often borne children (2). In those who have not borne children it is but rarely observed, and then severe violence must always operate, or the attachments of the womb be relaxed by great previous flow of *mucus* (3). During pregnancy the womb cannot easily protrude, and a considerable prolapse is itself removed by the ascent of the womb. Cases are mentioned (*c*) in which prolapse has occurred during pregnancy, and even during delivery (4); in such, violent straining must have operated, and the diameter of the *pelvis* have been of great size. Any diseased change of the womb which increases its weight, for instance, polyps and so on, or swellings which press upon it, may favour its prolapse (5).

[(1) Among the causes of prolapse of the womb, Blundell notices especially, a large *pelvis;* and he observes, that "this descent of the *uterus*, to which all females may be subjected, when the parts are relaxed, occurs certainly most frequently where the *pelvis* is capacious, and not only in the *earlier* but sometimes in the *later* periods of gestation." (p. 116.)

(2) Ramsbotham observes, that "in the higher circles, indeed, these (last) causes do not obtain; and in them, therefore, we more often find it consequent on miscarriage or accompanying a broken state of health. All women are aware of the necessity of confinement after delivery of a mature *fœtus*, and consequently, if they have it in their power, they willingly follow the course prescribed for them. But when they have passed an *ovum* of only two or three months' age, as they have suffered but little pain and less discharge, and as they had scarcely been sensible of any enlargement in their person before the miscarriage commenced, they consider the occurrence of little import; they think confinement to the horizontal posture for two or three days quite sufficient, and feel a longer restraint irksome, and in spite of advice and remonstrances will busy themselves about their domestic affairs, while still the *uterus* is much too bulky and heavy to be sustained by its natural supporters." (p. 530.)

He also states that "a violent fit of coughing occurring soon after labour or abortion, or an attack of sneezing, although the woman may still retain the recumbent posture, is likely to produce *prolapsus;* and it may be occasioned by a rupture of the back part of the *vagina* and *perinæum*." (p. 530.)

(3) A remarkable instance of prolapse of the womb in a young woman (a virgin) was under Elliotson's care in St. Thomas's Hospital, in 1828 (*d*). She stated that "whilst lifting a person out of a coach, she suddenly felt intense pain in her back, and the *uterus* descended and protruded beyond the *os externum;* its descent was accompanied by profuse hæmorrhage. She was immediately placed in bed and a Surgeon sent for, who replaced the womb. In a month afterwards, feeling herself quite well, she married, and ever since (five months) that period has suffered exceedingly from pain in her back, and from repeated descents of the *uterus*, accompanied with hæmorrhage." (pp. 733, 34).

(*a*) Livr. xvi. p. 3.

(*b*) Pathologie Chirurgicale,

(*c*) Harvey, Exercitationes de Partu, p. 518.—Fabricius, Progr. de fœtûs vivi extractione, utero prolapso. Helmst., 1748.—Haller's Disput. chir. sel., vol. iii. p. 434.—Saviard, above cited, p. 66.—Ducreux and Portal; in Sabatier, above cited, p. 368.—Journal de Médecine, vol. xliii. p. 366, vol. xlv. p. 232. — Müllner, Wahrnehmung einer sammt dem Kinde ausgefallenen Gebärmutter. Nürnberg, 1771.

(*d*) Lancet, 1827-28, vol. ii.

Samuel Cooper states (*a*) that he has seen two instances of prolapsed womb in maidens, in the course of seven or eight years. Ramsbotham has known it twice in unmarried girls about twenty years of age. And other cases are related by Mauriceau, Saviard, Monro, and Cruveilhier.

(4) Ullsamer (*b*) mentions, that he had observed "prolapse of the womb to be in one village, as it were, endemic, in almost all the women who had borne one or two children; and when its cause was subsequently ascertained, it was found that the midwife of the place, who had never been instructed, put all the women, as soon as they had the slightest labour pain, into the labour-chair, which was her only mode of assistance, and let them go on and strain, till either the birth were effected or the woman could go on no longer." (p. 561.) This cause of prolapse is not likely to occur in this country, our women being put in the recumbent posture instead of on the labour-chair; but the fact is worth observation.

(5) Degeneration, accompanied with increased size of the neighbouring organs within he belly may, although rarely, cause prolapse of the womb, as dropsy, or hardening of he ovaries, of which an interesting example is mentioned by Kuhn (*c*).

Clarke observes that "*procidentia uteri* and separation between the bones of the *pelvis* may exist together in the same patient," and mentions an instance of a young lady who, after her second confinement, was thus affected. "During and after this labour there was a considerable discharge of blood, but in other respects she was well. At the end of a fortnight she found herself incapable of standing, and all the symptoms returned, as after her former labour," (pain in the back and groins, uneasiness in the region of the stomach, and impaired digestion, *hysteria*, and mucous discharge from the *vagina*, which were diminished by the use of a pessary, astringent injections, sea bathing, and tonic medicines.) By the use of the means above mentioned, the fresh water bath being used of necessity instead of the sea bath, the symptoms all left her, excepting the pain in the back, and the incapability of standing for half a minute unless supported on each side. Whenever she made the attempt to stand, she placed her hands upon the sides of her hips. This led the author to make a firm pressure there with his own hands; and as long as this was firmly applied the patient could stand, but as soon as this support was withdrawn she was in danger of falling." (p. 78–80.) She was cured by wearing for sometime a leathern belt. an inch and a half wide, applied as tightly as she could bear it without pain. Clarke states that he has met with many similar cases, which recovered, but that the "progress of such cases towards health is always exceedingly slow."]

1272. The *prognosis* of prolapse of the womb depends on its degree and causes; it is, however, always doubtful in reference to a radical cure. The symptoms may be very dangerous, especially if the prolapse have occurred quickly.

1273. The *treatment* consists in the *return* of the prolapsed womb, and in the *prevention of its reprolapse*.

1274. In *incomplete* prolapse the return is unaccompanied with difficulty; the womb usually returns of itself, when the patient is in the recumbent posture. But if this do not take place, the womb, after emptying the bladder and *rectum*, must be pushed back with the fingers, which are to be placed upon it, in the axis of the *pelvis*. In *complete* prolapse the reduction is generally more difficult, especially in fat persons, and may be impossible if the womb be considerably swollen and inflamed (1). In these cases the attempts at replacement must be made in the horizontal position, with the rump raised; warm bathing, bleeding, relaxing applications, and the use of cooling remedies, having been previously resorted to; and the reduction must always be carefully made, so as not to increase the symptoms. If the womb prolapse during pregnancy, it must be returned as quickly as possible (2.) If this cannot be done without efforts which may be dangerous to mother and child, it is to be feared that in the increasing size of the womb its circulation may be so prevented as to cause gangrene; in which

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(*a*) Surgical Dictionary, Seventh Edition, p. 1838.

(*b*) Cited at head of this article.

(*c*) Allgem. Medic. Annalen, part ii. p. 841. Altenburg, 1812.

case nothing remains but to diminish the size of the womb by breaking the membranes, and drawing off the waters; or the womb remains lying in front of the external genitals till the completion of the delivery, which in many instances (which happens also in those prolapses occurring during delivery) is effected merely by the natural powers, in some by artificial assistance, and even by cutting into the mouth of the womb (*a*). After delivery the bulk of the womb diminishes, and the reduction is easy.

[(1) "RUYSCH forbids the reduction of the prolapsed womb when it is ulcerated; but," observes SABATIER, "as this complication is only accidental, as it is only caused by the continual rubbing to which the tumour is exposed, and by the acridity of the urine with which it is bedewed, no danger is to be feared from this practice. We perceive, on the contrary, that as that which causes and sets up the ulcers with which the *vagina* and womb are affected ceases by its reduction, the ulcers will heal of themselves, when the womb is in its natural place; and experience supports the truth of this reasoning." (p. 365.)

(2) "When prolapse occurs during the course of pregnancy," SABATIER says that "its reduction must be attempted, which is sometimes tolerably easy, the pregnancy being but little advanced, if the reduction be made at once, and care have been taken previously to empty the bladder and *rectum* by the catheter and by clysters, and by putting the patient in a proper position. If, on the contrary, pregnancy be far advanced, or if the prolapse have existed some time, the reduction becomes very difficult and in this case it is more prudent to leave the part hanging out rather than to weary the mother and child by unavailing efforts. The womb, however, must not be left to itself; it must be supported by proper bandages, and the patient even kept in bed to the ordinary termination of pregnancy. If the prolapse happen at the time of delivery, reduction becomes useless, and even dangerous. We must then occupy ourselves with the delivery of the child by gradually dilating the womb, which must be carefully supported during the operation, which, though troublesome, presents no greater difficulty than when the womb is in its natural position. The extraction of the *placenta* requires much care. It is easy to perceive this must not be left to nature, and still less that the cord should be pulled in the usual way. The hand being introduced into the womb, the *placenta* must be detached according to LEVRET's method. After which the womb gradually contracts, and the reduction is tolerably easy." (pp. 369, 370.)]

1275. When the prolapse has been returned, the ailment is only of slight extent; and if it have not long existed, the patient requires to be kept several weeks on her back; in passing her motions, she should avoid all straining and sitting up, and she should use local and general strengthening remedies, as volatile frictures of the belly, astringent injections into the *vagina*, strengthening baths, especially tan baths, and so on (1). In this lesser degree of the disease, sponges moistened with astringent remedies may be introduced into the *vagina* (2). In complete prolapse the womb must, after proper reduction, be retained in its place by a mechanical contrivance, the so-called *pessary*.

[(1) CLARKE says that "in *procidentia uteri*, cold water ought to be applied to the female parts, to the belly, and to the back. by means of a sponge, three or four times a day; and the water for this purpose should be used as soon as it has been drawn from the spring. The water may be rendered still colder by the addition of some matter which is passing from a solid to a fluid state, as ice or salt. Cold water may also be thrown into the *vagina* by means of a syringe, or a piece of ice may be introduced into the *vagina* and suffered to dissolve there. In very slight cases of the disease, when the symptoms are just beginning, and when they are known to proceed from the causes which have been mentioned, they will be removed by attendance to these rules, assisted by the horizontal posture." (p. 95.)

"In *procidentia* of the *uterus*," CLARKE further observes, "astringent applications to the *vagina* become very serviceable, by diminishing its diameter, and thus rendering it less disposed to receive the displaced *uterus*; and also by restraining the mucous discharge." (p. 98.) "A mixture of alum and sulphate of zinc, in such proportions as the

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(*a*) Ephémérid. Natur. Curios., déc. II. an iii. p. 375. — JALOUSET; in Journal de Médecine, vol. lxiii nature of the case may seem to require, will sometimes fulfil the intentions of the practitioner better than either employed alone; and so of all the other mineral astringents which have been in use." p. 101. Of the vegetable astringents, "*cortex quercûs, cortex granati gallæ*, possess a great degree of astringency. They give out their astringent properties to water more readily by boiling than by infusion, and therefore the decoctions of them are to be preferred; they may be used alone, or some of the mineral astringents may be dissolved in them. By these means are procured astringent fluids of such strength, that the *vagina* may be so much contracted as even to render the introduction of the pipe of the female syringe difficult. Astringent injections should be thrown into the parts twice or thrice a day, or oftener, and they should be used cold." (p. 103.)

Upon the subject of injection, CLARKE states, that "whenever it is found necessary to inject fluids into the *vagina*, and important that they should remain there for any time, the operation should be performed when the woman is in a recumbent position; and if a pillow is previously placed under the hips, in order to raise them a little, the fluid will be less likely to escape. The syringe to be employed should be capable of holding as much fluid as will fill the *vagina*." He objects to the mode in which the holes are generally made in the syringe, by which either the fluid passes out too quickly, or little or none reaches the upper part of the *vagina*, "but if the holes are all placed at the extremity of the pipe, the injection will be thrown to the upper part of the *vagina*, and will be sure of return by the sides." (p. 95–7.)

"When ulceration has attacked the *vagina*, in consequence of exposure to air and pressure," CLARKE recommends that "a small quantity of some warm ointment be applied to the parts affected by it, such as the following:—℞ *bals. Peruv.* ʒij., *ung. cetacei* ℥j. M." (p. 103.)

(2) CLARKE objects to the use of sponge, as "the worst material which can be employed for pessaries; it is porous, and will very quickly imbibe the moisture of the parts. The piece of sponge must be large, compared with the size of the *vagina*, or it will be useless; and if it is large, the *vagina* (the dilated state of which was one of the causes of the disease) will be still further dilated; and although whilst the sponge is warm, the *uterus* will rest upon it, and the symptoms may be relieved, yet when it is removed the disease will return in an increased degree." (p. 112.)]

1276. Pessaries, (*Mutterkränze*, Germ.; *Pessaire*, Fr.,) in reference to their form and substance, are very various; they are oval, round, globular, cylindrical, furnished with a stem, and so on; they are made of wood, or cork, caoutchouc, and covered with wax or varnish (*a*).

1277. The oval pessary, made of cork overspread with wax, and provided in the middle with an opening not too large, is the most serviceable. It keeps its place whilst the two ends of the oval thrust against the sides of the *vagina* and *pelvis*. It is to be applied in the following way. The patient, her *rectum* and bladder having been previously emptied, lies on her back, with her rump raised, her thighs apart, and bent towards the belly, the *labia* are to be separated with two fingers of the left hand, and with the right hand the pessary, held flat, is to be thrust so high into the *vagina*, that the mouth of the womb may meet its aperture when it is brought horizontal, and its two ends jut on both sides against the pelvic bones. The patient must remain in the horizontal posture some hours after the introduction of the pessary to ascertain if it still keep its proper place. A larger pessary must be chosen if the womb again prolapse; and a smaller one, if that introduced cause too much presure. At the same time the strengthening remedies, already mentioned, (*par.* 1275,) must be used. If pregnancy occur, the pessary should be removed about the third or fourth month. The patient must then keep herself quiet, avoid all exertion, and, in delivery, all pressure and excitement of labour-pains.

(*a*) HUNOLD, Dissert de Pessaires. Marb., 1779.—BERNSTEIN, Systematische Darstellung des chirurgischen Verbandes, p. 352.—MEISSNER, above cited.—HERREZ DE CHEGOIN; in Mémoires de l'Académie de Médecine, vol. ii. p. 319.—Mad. RONDET, Mémoire sur l'emploi des Pessaires de caoutchouc. Paris, 1833.—ZIMMERMANN, Erfährungen und Mittheilungen bewährter Aërzte und Wundaërzte neurer Zeit über Prolapsus und Carcinoma Uteri nebst einer gründlichen Beleuchtung der Pessarien. Leipzig, 1834. fol. No. 148.—Gemeimsame Zeitschrift für die Geburtskinde, vol. vi. pt. i. ii.

[When the prolapse is so great that the globular pessary, which CLARKE thinks is the best, will not be retained, neither can be kept in the *vagina* by any common bandage, he recommends " a pessary to be chosen of the size which the case requires, and a small slip of brass to be attached to it by its two ends, leaving a space between the instrument and the centre of this piece of brass; a belt of leather, long enough to go round the patient's body, is also to be prepared; to the centre of which behind, a brass wire, as thick as a common quill, is to be attached by a screw. This wire is now to be properly bent, and the pessary being introduced into the *vagina*, the wire is to be passed between the pessary and the piece of brass attached to it; and being brought up between the thighs, it is to be attached to the fore part of the circular strap. The reduced parts are by this means supported by a pessary, and this is kept in its place by the unyielding piece of metal." (p. 127.)]

1278. The use of the pessary is frequently accompanied with much inconvenience, as it causes pain, inflammation, stinking discharge, suppuration, and even degeneration of the generative organs; in many cases it cannot be worn, and in many the prolapse cannot be kept up for any time (1). In such cases the only help consists in an *organic narrowing of the vagina* with or without excision of its walls, by means of the *suture*, *Elythroraphy*, (HALL, BÉRARD,) *Colpodesmoraphy*, (BELLINI,) or by junction of the *labia* by means of the *suture*, *Episioraphy*, (FRICKE,) or by the *introduction of a ring* (2).

[(1) The use of pessaries has of late years gone much out of fashion, on account of the many inconveniences which they cause; and in their stead many of our leading accoucheurs prefer the use of a modified T bandage upon the belly and *perinæum*. Among these, Dr. HULL's utero-abdominal supporter is perhaps the most known and commonly used in this country; and I have seen it employed very successfully several times in my own hospital patients, for whom it has been prescribed by our obstetric physicians. It does not appear certain that HULL was the real inventor of this bandage; at least, one very similar to it had been long previously made by SHELDRAKE of Leicester Square, and another and more simple had been invented many years before by KING, a Surgeon at Clifton. I am not aware, however, that any good explanation of the way in which such bandages act had been given, till HULL brought out his apparatus. He considers " *Prolapsus Uteri*, not as a displacement of the womb merely, but as a loss of that perfect equilibrium between the upper and lower portions of the *abdomen* which is essential to the preservation of the relative situations of the *viscera* it contains, and also a dislocation of the *uterus* and bladder; and in some cases, as especially dependent upon a pouch-like relaxation of the whole perinæal region. His method of cure consists in giving the weakened and relaxed portions of the muscular walls of the abdomen adequate mechanical support, which directly replaces the *viscera*, and gives back to the weakened walls their lost tone" (*a*).

The apparatus consists of a broad soft elastic pad, covering the whole hypogastric region, upon the middle of which the front end of a spring, like that of a common truss, acts, and from the hind end a strap passes round the opposite side of the body, and fastens on the pad. " The effect of this pad is to give the weakened lower portion of the abdominal muscles a congenial support, which, at the same time that it diminishes their labour, stimulates them by the well-known power of mechanical pressure upon muscular tissue, to a permanent renewal of their vigour. It reduces the distended *hypogastrium*, aids the upward forces of the belly, and by its direction, upwards and backwards, directly relieves the pelvic *viscera* from the unnatural pressure of the downward forces." That portion of the apparatus above described, is not always " competent to the entire relief of all cases of this species of uterine displacement; the *perinæum* sometimes losing so much of its muscular and organic contractility, as not to resume its natural dimensions and situation, even when the downward forces are stayed by the hypogastric pad. In cases of this character, although the abdominal support of the apparatus does certainly relieve many of the distressing sensations of the patient, yet the distended floor of the *pelvis* remains a *cul-de-sac* for the reception of the *viscera*,

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(*a*) This extract I have taken from " A brief Account of the application and uses of the Utero-Abdominal Supporter, for relief and cure of *Procidentia* and *Prolapsus Uteri*, patented by A. G. HULL, M.D." London. Published by WEISS, of the Strand, who is agent for these bandages. The original pamphlet, published in America about ten years ago, I have in vain endeavoured to procure.—J. F. S.

whenever that apparatus is removed for a length of time. To obviate this liability, as also to give tone to the *vagina* by the stimulus of mechanical pressure, thereby to diminish its calibre, and restore it to its natural situation, the doctor applies against the *perinæum*, externally, a prism-shaped pad or cushion, made of sponge, firmly encased in cloth, which is held in its place by a strap passing between the thighs, and over the perinæal region, in the manner of a ⊤ bandage. This perinæal cushion, with its rising and sinking in perfect accordance with the respiratory motions of the *diaphragm* and abdominal walls, keeps up an equal, firm, and, to the patient, agreeable pressure upwards, is a good substitute for the intervaginal pessaries."

SHELDRAKE's bandage is very similar to HULL's, but without the spring.

KING's bandage is very simple, and I am informed very efficient; it is, in fact, a ⊤ bandage, of which the circular part is in two pieces, one passing round the back of the *pelvis* from below, the upper front spine of one hip-bone to the other, and its ends connected in front by an elastic strap, rather wide in the middle, to which is attached a perinæal strap, also elastic, and padded more or less thickly in the *perinæum*, according to circumstances.

(2) PHILLIPS (*a*), in a case of prolapsed womb, for the relief of which the patient could not bear the use of any pessary, attempted to produce a scar of the *vagina* by destroying its mucous surface with caustic, for the purpose of causing such contraction of the passage as would prevent the descent of the womb. Having introduced a three-pronged *speculum vaginæ* and freely expanded it, he liberally applied lunar caustic upon two of the exposed surfaces, and afterwards washed out the *vagina* with warm water. The application gave very little pain, but its effect did not extend beyond the *epithelium*, and when this peeled off there was not any appearance of granulating surface. Six weeks after he " used the fuming nitric acid, brushing it over a larger surface by means of a camel's-hair pencil. The pain it occasioned was greater than that which followed the use of the nitrate of silver, but still it was not severe nor long-continued. The inflammatory action was much more decided, the whole thickness of the mucous tissue sloughed, and a fair granulating surface, yielding a considerable purulent secretion, was established." (p. 495.) The descent of the womb did not at first appear to be much checked, and it was thought of bringing the sides of the *vagina* together with suture, to which however the patient would not assent. Gradually the descent of the womb diminished, and for eight months had entirely ceased, the capacity of the *vagina* having diminished to that of a woman who had never borne children.

If pessaries be used, they should be occasionally removed to cleanse them of any acrid or gritty substance which may have become attached and be likely to excite inflammation and ulceration. CLARKE also remarks, that " instances too have occurred, where parts of the instrument have been destroyed by a spontaneous change taking place in it, and angular portions of it having been left, which have produced similar bad effects ;" of which he gives an instance. And he also mentions a remarkable case, in which " a supposed schirrous tumour surrounding the *os uteri* was found to be a cork pessary, introduced many years before, and rendered very rough by calculous matter deposited on its surface. It was withdrawn, and all the symptoms subsided in the course of a week." (pp. 116, 17.)]

1279. According to HALL (*b*), after the womb has been forced down by the patient's efforts as much as possible, two parallel cuts should be made along the whole length of the *vagina*, from the neck of the womb to its entrance, through the mucous membrane, which is to be separated, so that an interspace of two and a half inches is laid bare between the two incisions. A stitch is then to be put in through both edges of the wound near the neck of the womb, the womb itself to be returned, and the threads tied firmly together. Several ligatures may in the same way be gradually applied (1).

IRELAND (*c*) has successfully practised HALL's method, which he has only modified with the view of avoiding more certainly the bladder and *rectum*, by making the incisions on the sides nearly parallel, but converging at their extremities, by removing the flaps above and below, and applying all the sutures before returning the womb.

(*a*) London Medical Gazette, New Series, 1838-39, vol. ii.

(*b*) London Medical Gazette, vol. ix. p. 269. 1830.

(*c*) Dublin Journal, vol. vi. p. 486. 1835.

Velpeau and Berard have performed Ireland's modified operation, but they also removed a third slip from the front of the *vagina* (*a*).

[It has been a dispute with whom this operation originated. Velpeau, in his Clinical Lecture just cited, says, that "the first idea of this operation is due to Gérardin, who described it in a memoir which he presented to the Société de Médecine de Metz ou de Nancy, which however was never published. He proposed to contract the *vagina*, and if necessary even to obliterate it, in women in whom the *catamenia* had ceased. He found many opponents to his ideas, which were rejected." (p. 276.) Velpeau does not mention in what manner it was proposed to effect the contraction of the *vagina*, neither does Gérardin himself in his letter to the Académie (*b*), in which he says, that "before 1823 he had proved that the pessary might be replaced by and the cure of prolapsed womb radically effected by a surgical operation." It is therefore just possible, though not very probable, that Marshall Hall might have been aware of Gérardin's suggestion before he proposed and had his operation performed by Hemming (*c*) in the autumn of 1831.—J. F. S.

(1) Dieffenbach (*d*) made use of the actual cautery for the cure of prolapsed womb; but not being satisfied with it, has laid it aside. Lawrie of Glasgow, however, mentions (*e*) the case of a girl of eighteen, who had prolapsed womb suddenly produced by carrying a heavy tub; nitrate of silver was freely applied, astringent injections and other remedies used, and strips of the mucous membrane dissected off the sides and back of the *vagina*, but without benefit. He then, having dilated with Weiss's *speculum*, applied the actual cautery on either side of the *vagina*, nearly as high as the womb. The operation was very painful, the external parts became œdematous, she had retention of urine, some pain in the belly, and hysterical symptoms, which readily yielded to mild treatment. She was kept in the recumbent posture for six weeks; and left the hospital nine weeks after the operation, without the least tendency to the renewal of prolapse; but having a circular contraction of the *vagina*, just below the womb. Nine months after, the protrusion recurred, after long standing and unwonted exercise. The actual cautery was again applied, the same symptoms produced, but subsided, after one bleeding, aperients, fomentations, &c. She was kept in bed for nine months; then allowed to get up, wearing a compress in the *perinæum*, and a T bandage, and was perfectly cured.

Ker (*f*) mentions a case of prolapsed womb, which would not yield to the usual means for its return, but was treated effectually with ergot of rye. The woman had had external prolapse for three years, which returned when she lay down; but at last a complete prolapse of the *uterus* took place, which could not be returned. "Sixteen hours after, the *uterus* was considerably enlarged, little, if at all, below the size of the fœtal head; indeed, in a condition decidedly œdematous." Attempts at reduction, mild aperients, warm fomentations and injection, all failed; and after having been persisted in for twenty-four hours, it was determined to give the *Secale cornutum* in scruple doses every three hours. After taking the first dose she complained of a great deal of grasping grinding pain in that which was down, very much resembling labour, and these pains increased on each succeeding dose. On examination, a material diminution in the size of the prolapsed womb was found to have occurred, so much so that the *rugæ* of the *vagina* were perfectly manifest, and without any great effort the reduction was effected.]

1280. Bellini (*g*), with a pair of hook forceps, grasps the upper segment of the externally-protruded *vagina*, draws it down, and, giving the forceps to an assistant, begins at the outer edge of the vaginal commissure, upon the left side of the swelling, with a flat curved needle armed with two threads, to unround it, and with the thread form a half-circle, in the form of a horse-shoe, or an ∩, and thrusting the thread in and out at intervals of two lines. To prevent injury to the *rectum*, the forefinger of the left hand must be introduced, for the careful direction of the needle, which should be passed no deeper than the walls of the *vagina*, and with every stitch only one line of it is to be taken hold of. When the upper part of the swelling is reached, it must be surrounded with

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(*a*) Archives Générales, vol. viii. p. 515, Second Series.—Journal Hebdom., vol. iii. p. 275. 1835.

(*b*) Gazette Médicale, vol. iii. p. 538.

(*c*) London Medical Gazette, 1835, vol. i. p. 266.

(*d*) Medicinische Vereinszeitung, 1836, No. 13.

(*e*) Medical Gazette, vol. xxviii. p. 757. 1841.

(*f*) Efficacy of the *Secale cornutum* in a case of Irreducible Prolapsus Uteri; in London Medical Gazette, vol. xiv. p. 604. 1834.

(*g*) Bulletino delle Scienze Medica. Nov., Dec., 1835.

four stitches, and the needle carried in the same way downwards, to complete the horse-shoe. The ends of the threads are now to be drawn together, so as to fold up the prolapse, and then fastened with a loop knot. The after-treatment consists in rest, blood-letting, cold fomentation, and diet. After two or three days, the threads may be drawn tighter. A portion of the mucous membrane of the *vagina* separates after ten days, a scar forms in the *vagina*, and prolapse never recurs.

1281. *Episioraphy* is performed, according to Fricke (*a*), in the following manner:—After the patient has been properly placed, the Surgeon takes hold of one *labium* with one hand, thrusts in a pointed bistoury about two fingers from the upper commissure, and a full finger's breadth from the edge of the *labium*, and carries it down to the *frænulum*, where he brings it out again in a small curve, so that a portion of the *labium* of a finger's breadth width is separated, and then the upper still attached part of this portion of skin is to be completely cut through in an oblique direction. The same proceeding is to be adopted with the other side, and so carried on to the *frænulum* that a part of the latter is removed, and both cuts brought together at an angle, at a finger's breadth from the *frænulum*. After the bleeding from the spouting arteries has been stopped by torsion, and from the little vessels by cold water, both edges of the wound are to be brought together with from ten to twelve stitches. It should be previously considered whether the prolapse can be kept up merely by quiet position or not; and in the latter case, previous to putting in the stitches, a piece of oiled sponge, upon which a thread is attached, should be introduced into the *vagina*. The patient, after the operation, is to be laid on her side, with the rump somewhat raised, and the knees tied together. Applications of cold water or lead wash should be made to the wound, and the urine drawn off by the catheter, for the first few days. Though, however, no perfect union ensue, yet usually the prolapse is partially kept up. The vaginal *mucus* and the menstrual blood escape, and *coitus* can be effected by the opening remaining at the upper part. Should pregnancy ensue, the adhesion may be divided, or cuts on the sides made at the time of delivery (1).

(1) Kock (*b*) uses the quill-stitch in *episioraphy*.

Plath (*c*) gives the account of a birth after *episioraphy*. A bridge still existed; in delivery the lower opening dilated, and was still further enlarged by three cuts on the sides. The result was completely satisfactory.

[Geddings of Maryland (*d*) has performed successfully the operation of *episioraphy* four times in the following manner. The patient being placed in the ordinary position for lithotomy, and the *prolapsus* reduced, one *labium* was put on the stretch by an assistant, and an incision was commenced, with a common scalpel, about a finger's breadth from the upper commissure, and the same distance from the edge of the *labium*. The incision was carried downwards with a bold sweep, and terminated by a slight curve inwards, and at a little distance behind the *fourchette*. A slip of the *labium*, of a finger's breadth in thickness, was thus severed from the external parts, taking care not to cut through the mucous membrane of the *vagina*. Making traction on this slip downwards and inwards, the mucous membrane of the lateral portion of the *vagina* was then dissected up to the extent of an inch and a half, and detached with the excised *labium*. The same was repeated on the opposite side, the incision being so directed as to intersect the first cut at an acute angle, and remove the *fourchette* with the other parts. After the slight hæmorrhage had ceased, an oiled sponge was introduced into the *vagina*, and the two raw surfaces brought into apposition by the quilled suture of

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(*a*) Annalen der chirurg. Abtheilung des Krankenhauses zu Hamburg, vol. ii. p. 142.

(*b*) von Graefe und von Walther's Journal, vol. xxv. p. 667.

(*c*) Hamburger Zeitschrift, vol. ii. pt. ii.

(*d*) American Journal of Medical Science, vol. ii. p. 18; also Braithwaite's Retrospect, vol. iii. p. 151. 1841. Second Edition.

five stitches. A compress of lint, and a T bandage were applied, and the parts kept cool with cold water. The sponge which had been introduced to keep up the womb till adhesion had taken place, was generally removed about the fifth or sixth day; and the sutures were taken out, as the parts seemed to have united.]

1282. For the purpose of holding the *labia* together, and thereby preventing prolapse, a hinge ring, about the size of a large earring, should be used; it is to be drawn through the lower part of both *labia* and closed, so that it may lie in the region of the *frænulum* (*a*).

1283. An old prolapse oftentimes cannot be returned without causing anxiety, pain in the belly, costiveness, and other symptoms (*b*). In this case, the womb must be supported with a bandage, and care must be taken for the proper emptying of the bladder and *rectum* (1). If the completely prolapsed womb be so changed by disease, as for example, by *schirrus*, that its removal is indicated, this must be effected by the ligature (2) or by incision; the latter at least has been done successfully, by LANGENBECK (*c*) (3).

[(1) When, in consequence of the altered position of the bladder often attending prolapse of the womb, the urine cannot be voided, and it becomes necessary to introduce a catheter, the altered direction of the *urethra* must not be forgotten; and according to the directions of CRUVEILHIER, the instrument must be directed downwards and backwards with its concavity downwards, and thus it "first enters the displaced part of the bladder and is afterwards raised by a lever-like movement into that portion of it still remaining in its natural situation" (*d*).

(2) The removal of a prolapsed schirrous womb was effected with the ligature by RECAMIER and MARJOLIN; but the woman died from some cause independent of the operation. CRUVELHIER, who mentions this case (*e*), objects to the treatment as being accompanied with great risk of including a portion of the bladder in the ligature. He recommends, in preference, cutting through the back of the *vagina*, into the doubling of *peritoneum* between it and the *rectum*, then drawing the womb through the aperture an detaching it from its cellular connexions with the bladder.

(3) In LANGENBECK's operation, the womb, after cutting across the *vagina*, was drawn down, separated from the *peritoneum* without opening its cavity, and cut off, excepting a small portion of its *fundus*, which being healthy, was left undisturbed.]

II.—OF PROLAPSE OF THE WOMB WITH INVERSION.

(*Prolapsus Uteri cum inversione*, Lat.; *Vorfalle der Gebärmutter mit Umstulpung*, Germ.; *Chute et Renversement de la Matrice*, Fr.)

SABATIER, above cited, p. 375.

FRIES, C. F., Abhandlung von der Umkehrung oder eigentlichen, in version der Gebärmutter. Münster, 1804.

HERZOG, E. B., Dissert. de inversione uteri. Wirceb., 1817.

NEWNHAM, W., An Essay on the Symptoms, Causes, and Treatment of Inversio Uteri; with a history of a successful extirpation of that organ during the chronic stage of the disease. London, 1818.

CROSSE, JOHN GREEN, An Essay, literary and practical, on Inversio Uteri; in Trans. of the Prov. Med. and Surg. Assoc., New Series, vol. i. p. 285. 1845. 8vo.

1284. Under the term *Prolapse of the Womb with Inversion* is understood the dropping down of the *fundus* of the womb into its cavity, and the sinking down of the *fundus* and body into the mouth of the womb, into the *vagina*, and even its protrusion at the external generative parts.

(*a*) KRAUS; in Medicinischen Correspondenz-blatt des Würtemb. ärztl. Vereines., July, 1843, Nov. 20.—HEYFELDER, Das chirurg. und Augenkranken Clinicum der Univers. Erlangen, 1843, p. 45.

(*b*) RICHTER's Chirurg. Biblioth. vol. iii. p. 141.

(*c*) Neue Biblioth. für die Chirurg. und Ophthalm., vol. i. p. 551.

(*d*) Livr. xxvi. p. 2.

(*e*) Livr. xvi. p. 4.

It is, therefore, distinguished as *incomplete* and *complete inversion;* in the former case the *fundus* of the womb protrudes more or less through its mouth, and forms a semicircular swelling, which is encompassed by the mouth of the womb; in the latter the whole womb is protruded, from its *fundus* to its neck, through its mouth, and lies in front of the external generative parts in shape of a pear-formed swelling.

[Crosse observes :—" Inversion of the *uterus* is either partial or total; the latter can exist only in one degree, and admits of no subdivisions. Partial inversion, on the contrary, comprises very many degrees; and there are both physiological and practical reasons for noticing and describing three, by way of classification; namely, *depression*, *introversion*, and *perversion.*

Depression, the first division and slightest degree of partial inversion, is present when any portion of the entire thickness of the walls of the *uterus* becomes convex towards its cavity or interior, without going to the extent of being invaginated, or brought within the grasp of the rest of the *uterus*, supposing it to contract by the action of its muscular coats. The interior convexity is answered by a concavity of the same extent on the exterior surface of the womb. The posterior, lateral, or even perhaps the anterior part of the body of the organ, may be thus displaced after parturition; but usually the *fundus* is the part affected. * * * The palpable evidence of this degree of inversion is obtained by examination through the *parietes* of the *abdomen*, or by the hand *in utero* meeting with a convexity of more or less firmness according to the atonic or contracted state of the part, and giving the idea of a *placenta* still remaining, after the entire *placenta* has been removed. If the *placenta* be still adherent, its attachment is to the inverted portion, and any attempt to remove it by traction will increase the inversion.

Introversion is when so great a part of the *fundus* is displaced, as that it comes within the grasp of the portion of the *uterus*, into which it is received. The greatest degree of this displacement consists in the *fundus* and continuous part of the body of the *uterus* being received into the remainder of its body and *cervix*, the convexity of the *fundus* being palpable at the *os tincæ*. The inverted portion is in a situation to be resisted, supported, compressed, and otherwise acted upon, by the uninverted, by which it is always surrounded. In proportion to the degree of introversion is the depth and extent of the peritoneal pouch opening towards the *abdomen*. The uterine ligaments are in part drawn into this pouch, and the *ovaria* approximate, the marginal circle corresponding to the angle of inflexion. On examining above the *pubes*, the circular margin of the *uterus* can be felt forming the boundary of the inversion, and the *uterus* and part of the body of the organ are wanting; in a thin patient, and where the abdominal *parietes* are relaxed and yielding, the fingers of the accoucheur may even enter the orifice of the peritoneal pouch, pressing those *parietes* before them. If the *placenta* be still attached, it is felt at the *os tincæ*, or in the cavity of the *uterus*, and judged to be of unusual size; if partially detached it allows of great hæmorrhage, which may cease on its removal, if the inverted *fundus* contract, and be felt firm to the touch; but hæmorrhage continues if the inverted mass be soft, indicating that it is still in a state of *inertia*.

Perversion is when more or less of the inverted portion of the *uterus* projects through the *os tincæ;* in its greatest degree the whole body of the *uterus* as well as the *fundus*, passes inverted through the *os*, the *cervix* only remaining *in situ*, encircling the contiguous or highest part of the inverted portion, all the rest being uncompressed and unsupported by the *uterus*. The peritoneal pouch is lengthened, and the proper uterine cavity nearly obliterated. Where " the inverted part is surrounded by the *cervix*, it may constrict it, producing congestion and even strangulation in all the rest of the inverted organ below. The angle of inflexion (so first named by Radford of Manchester) is always below the middle of the body of the *uterus*.

In considering the successive steps of the inverting process, we trace the descent of the *fundus* through the uterine cavity until it projects at the *os*, fills the *vagina*, and reaches the external *labia*; and the process may go on in the same direction to its completion, the inverted *fundus* and even body of the *uterus* prolapsing externally, until the encircling *cervix* descends, under expulsive efforts, to a level with the *labia*, and becomes apparent under ocular examination. But if the *labia* resist sufficiently the further descent of the *fundus*, and part of the body of the *uterus* remains still uninverted, may not the process be carried to its completion by ascent of the *cervix?* No author has hinted at this view of the subject, and yet its correctness must be admitted, in order to explain the well-established fact, that where the inverted *fundus* and body of the *uterus* are still in the *vagina*, the *cervix* is felt high above the *pubes*, even near to the navel, sometimes taking the situation the *fundus* would normally occupy, the *vagina* being proportionately stretched and carried upwards,—changes which can only be explained by supposing that, at a certain stage, the inversion ceased to progress by descent of the *fundus*, and was continued and completed by ascent of the *cervix*. If the *placenta* be still adhering, it precedes the *fundus*, is felt in the *vagina*, or observed at the external *labia*, giving the attendant an impression of its being firmer than usual, and of greater size. * * * If the *placenta* be already away, a convex tumour occupies the *vagina*, of a greater or less size, according to the proportion of the body of the organ inverted, having a soft, slightly nodulated surface, bleeding easily under the touch, its highest part encircled by the *cervix*. If the *cervix* only remain uninverted, the *fundus* and body of the *uterus* may be so large as to fill the bony *pelvis*, distend the *vagina* and render it difficult, if not impracticable for the accoucheur to reach the *cervix*; but as often as the inverted mass prolapses at the *vulva*, the encircling *cervix* can be felt. * * * Examination above the *pubes* may enable the accoucheur to detect the orifice leading to the peritoneal pouch, formed by the inverted *fundus* and body of the *uterus*, or in the case of external prolapse at the *vulva*, to convince himself of the absence of the organ from the abdomen. (p. 283–99.)

"In all degrees of inversion," says Crosse, "there is a concavity or pouch lined with *peritoneum*, and open toward the general peritoneal cavity. In simple depression the intestines rest in the concavity; and as the pouch or *cul-de-sac* increases, the intestines may, if the opening into it be large, occupy this pouch, so that in total inversion, with prolapse, they may actually descend beyond the external *labia*, still resting in the peritoneal bag, which the inversion has occasioned." (p. 308.)]

1285. The inversion of the womb occurs either suddenly or gradually; the former is possible only during delivery, when it quickly follows if the woman be in the upright posture, and strain very violently at the moment when the child is forced out; or it may occur from pulling at the navel-string, from too short or coiled up navel-string, and so much the more as the *pelvis* is wide (1). The inversion may be produced gradually by polypous growths at the *fundus* of the womb (2), by a slight in bending of the *fundus*, which remains after previous delivery, and gradually increases; in which case there is generally only imperfect inversion (3).

(1) According to Hachmann (*a*), there may be spontaneous inversion dependent on spasm, probably from deficient contraction of the womb, analogous to partial contraction, which is observed in stricture of the womb, in which case, for instance, the relaxed and toneless *fundus*, sinks inwards, is grasped by the contracting body, and descends completely down to the mouth of the womb.

[(2) On this point Clarke observes:—"It is said that inversion may be produced by the weight of a *polypus* attached to the *fundus* of the *uterus*. This cause may, of course, render unmarried women the subjects of this disease; but it will be rarely met with, first, because *polypus* itself is infrequent; secondly, because the *polypus* must be very large and heavy, that it may, have the power of drawing down the *uterus*; thirdly, because an unimpregnated *uterus* is unyielding and firm; and fourthly, because the *polypus*, to produce that effect, must be attached to the *fundus* of the *uterus*." (p. 150.)

Crosse, however, says:—"Next to pregnancy, the most frequent cause of enlargement of the *uterus* is a polypous tumour, which, when attached, as often happens, to the internal *fundus* of the organ, may occasion its inversion in all the different degrees that have been referred to. Any of the various tumours that progress towards the uterine cavity, and take the polypoid form, may induce inversion; but the vesicular *polypus*, being softer and of less density than others, and having usually a narrow neck, is less likely, in the progress of its growth and of its expulsion, to cause uterine inversion, whilst the *polypus* of great density, and with a broad basis, and particularly the fibrous, is not unfrequently followed in its later stages by the displacement in question." (p. 321.) Inversion of the womb from *polypus* is as various as from any other cause. "At first so partial," says Crosse, "that the *polypus* is still situated in the *uterus*, and next it descends into the *vagina*, bringing the inverted *fundus* to the *os*; then the *polypus* protrudes at the *labia*, the displacement being carried to the greatest degree of partial inversion, and filling the *vagina*, whilst the *cervix* alone continues

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(*a*) Einige Falle von krankhafter Lageveränderung des Uterus; in Hamb. Magazin der Ausländ Literatur. Nov., Dec., 1834, p. 352.

in situ, or is itself inverted, with part of the *vagina*. A further stage remains, in which the uterine inversion is total, and prolapses externally, bringing with it the *vagina*, also inverted. (p. 331.) If the *polypus* be attached to any part of the *fundus*, at the terminating opening of either of the Fallopian tubes, or in the interspace between those openings, it may determine a partial and limited inversion, whilst still remaining wholly or chiefly within the *uterus*. The symptoms are the same as a *polypus* produces, without inversion, and cannot be considered characteristic, although generally more severe, such as uneasiness in the uterine region, forcing pains, *leucorrhœa*, and *menorrhagia*." (p. 324.)

(3) " In addition to what has been already stated, we may," says CROSSE, " enumerate coagulated blood accumulated in the *uterus*, and an hydatidous growth, or mole, occupying its cavity, each of which has been known to cause uterine inversion." (p. 338.) Of the majority of the cases referred to the former cause, CROSSE has considerable doubt. " Some," he says, " are unsatisfactory, others evidently stated in error, the epoch of the inversion having manifested itself to the unsuspecting or uninstructed observer, (perhaps some seven or ten days after delivery,) not being the commencement of the displacement, which was coincident with the termination of the labour. With more correctness may we regard distension of the *uterus* from blood as a cause of the *relapse* of inversion." (p. 339.) As to the cases uncomplicated with pregnancy, " where blood was the primary cause of enlargement of the uterine cavity," he says, " I cannot quote any so objectionable as the case related by Mr. WATKINSON (*a*), in which a woman of fifty years of age had inversion take place under protracted and very severe *menorrhagia*, in which, as WATKINSON supposed, in a relaxed state of the *os uteri*, and perhaps of the *uterus* itself, owing to protracted hæmorrhage, the organ became inverted on the expulsion of *coagula*. At the expiration of four or five years the inverted womb hung half way down towards the knees, with a neck formed by the inverted *vagina*, about the size of one's wrist. The patient was reduced to imminent danger of life by sloughing and abscess, when the *uterus* was removed by incision below a ligature placed on the *vagina* with a fatal result. Of inversion following the expulsion of hydatidous masses, he mentions the case recited by Dr. THATCHER, of Edinburgh, in his lectures, in which the woman acknowledged that she had pulled away a protruding mass, which consisted of an immense accumulation of hydatids, firmly cemented by nearly cartilaginous bands, and had thus produced the same result as from injudiciously pulling the umbilical cord for the extraction of the *placenta* after delivery. There was " every diagnostic mark of the inverted *uterus*, with the *os uteri* clear and defined, surrounding its upper base." Attempts to return it were fruitless, and " at midnight the *uterus* was close down on the *os externum*. Next morning it was found fully protruded at the *vulva*, in shape and size like the largest caoutchouc bottle for injection." It could not be returned, and therefore, on the third day " a ligature of silver wire was applied close to the *os uteri*, with the double *canula* as for *polypus*. The ordinary means for supporting strength and preserving cleanliness were used. On the third day from the application of the ligature separation was nearly effected, and the slightly remanent portion was divided with the scalpel." (p. 340–42.)]

1286. The quick-formed inversion of the womb is commonly accompanied with severe pain, bleeding, inflammation, and swelling of the prolapsed part, and if it be complete, with sickness, fainting (1), convulsions, depressed powers, small and scarcely distinguishable pulse, and with danger of mortification and death ; in a complete inversion, however, all the symptoms may be absent (HACHMANN.) The slowly forming inversion of the womb prevents the discharge of the urine and stools, causes irregular menstruation, bleeding, inflammation of the womb and neighbouring parts, pain in the belly, hæmorrhoidal inconveniences, whites, hardening, excoriation and ulcers of the womb (2), bad nourishment, dropsical swellings, hectic fever, and so on.

[(1) Upon these symptoms DAILLIEZ (*b*) makes the following interesting observation :—" A loop of intestine may follow the *fundus* of the womb, insinuate itself into the cavity, of which the entrance is at first very large, become strangulated, as has been observed after bursting of the womb, and give rise to new symptoms, which have

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(*a*) London Medical and Physical Journal, vol. vii. p. 435.

(*b*) Thèse.

hitherto been merely regarded as sympathetic. The intestinal pains, the swelling of the belly, the sickness, vomitings, hiccough, so frequently attributed to reversion of the womb, may actually depend in some women only on this strangulation." (p. 80.)

(2) "Whilst the inverted *uterus* remains in the *vagina*, the discharge (excepting at the periods of menstruation) will be of a mucous kind," observes CLARKE; "but if the *uterus* falls lower, so as to protrude beyond the external parts, the exposure of that surface, which, in a natural state, lined the cavity, to air, as well as to occasional injuries, may induce inflammation and ulceration over a part, or the whole of its surface; and the mucous discharge may be changed to one of a purulent kind, so considerable in quantity as to debilitate the constitution, and to cause all the common symptoms of weakness. If there are any ulcerations upon the surface of the upper part of the tumour, formed by the inversion of the *vagina*, they will be circumscribed, and rarely cover its whole surface." (p. 155.)]

1287. Inversion is distinguished from prolapse of the womb by the pear-shaped swelling, broad below, on which no opening is found (*par.* 1269.) The distinction from a polyp of the womb is always difficult, and depends on the following circumstances; in the complete inversion, the form of the swelling resembles indeed that of the polyp, but it is enclosed at the upper part by a fold, and neither the finger nor a probe can be passed up between the swelling and this fold, as it can in polyp; the completely inverted womb has also at its upper part, from being hollow, a soft and yielding character. But this distinction is especially difficult in an incomplete and slowly produced inversion. When the inverted womb still lies in the *vagina*, it is broader above than below, but the polyp has the directly contrary form; the swelling of the prolapsed womb has a more definite feel than the polyp, which last is more movable and its surface smoother than that of the prolapsed womb. The simple inbending of the womb may in some degree be felt through the skin of the belly. The *diagnosis* is considerably assisted by the origin of the ailment after previous delivery. But all these circumstances may, in certain cases, lead to no definite results; for the form of polyps as well as their sensibility and mobility varies; both swellings may present a smooth or uneven surface; the polyp may appear soon after birth; the examination of the belly in stout persons gives no result. It seems to deserve particular attention that the polyp, when it has once penetrated the mouth of the womb, grows remarkably quick.

1288. The first indication, in inverted womb, is to return it to its place as soon as possible, because otherwise by the quickly ensuing inflammation and swelling, its replacement is difficult and impossible. If the inversion be incomplete and recent, it is sufficient to thrust up the bottom of the womb gently through its mouth, with the fingers of the right or left hand collected in a conical form. If the inversion be complete, if it have continued some hours or days, the *fundus* must be grasped with the whole hand, and whilst gently compressed, should be pushed up in the axis of the *pelvis*. In difficult cases the object may perhaps be attained, if two fingers be passed by the side of the protruded *fundus* of the womb into its mouth, enlarging it and then first returning that part next the mouth and afterwards the bottom of the womb. After the reduction is completed, the hand is to be kept in the womb till, by simultaneous rubbing and sprinkling the belly with cold water, it have perfectly contracted, and the after-birth if still retained, have been thrown off (1). Quiet in the supine posture with the rump raised, and the avoidance of all exertion, are favourable to keeping the returned womb in place (2). If the replacement be impossible, from the inflammation and swelling, or if on account of the increase of dangerous symptoms, especially of convulsions, it cannot be undertaken, then, after the womb has been gently thrust into the *vagina*, it must be attempted to diminish the swelling by suitable antiphlogistic treatment, and by simultaneous emptying of the bladder and *rectum*, before proceeding to its return (3). Attempts at replacement must not be continued too long, nor too violently, because thereby the most dangerous symptoms arise; but should be repeated after a suitable pause. In one such case the womb has been seen to return by the ensuing contraction (*a*).

(1) If the *placenta* remain still attached to the prolapsed womb, its separation must be first effected, before any attempt at replacement, because the reduction together with that of the *placenta* is considered impossible; but as this is contradicted by experience, the removal of the *placenta* renders the reduction doubtful, and dangerous bleeding may be easily produced; so the greater number of modern accoucheurs agree to attempt its reduction, together with that of the *placenta*, and only to remove it when it adheres very slightly.

(2) In chronic inversion, it becomes more difficult to preserve the womb in its place, because it has lost its power of contractility. To effect this, some have recommended the introduction of pessaries, (Rousset,) of several pieces of sponge, (Jörg,) of a caoutchouc bottle, (Fries,) and of peculiar supports for the womb, (Löeffler, Siebold.)

[" In a case where the *uterus* has been long inverted, and lies in the *vagina*, (the latter cavity having undergone no change, except from distension,) it will not be advisable," says Clarke, " to recommend any other remedy than the injection of some very mild astringent fluid three or four times a day, into the *vagina*. Some restraint will thus be placed upon the quantity of the discharge, and the parts will be kept clean by it. Pessaries are useless; the *vagina* being already so completely filled that nothing more can be retained in it." (p. 156.)

(3) In the treatment of recent inversion, Clarke lays down, that " the *uterus* is to be first returned to its usual state and natural situation; and the case then becoming simply one of a retained *placenta*, is to be treated as such; but if, neglecting this order of proceeding, the *placenta* should be first removed, a number of bleeding vessels will be exposed before the *uterus* can contract, so as to restrain the hæmorrhage; and the chance is, that the patient may die from its effects." (p. 152.)

Inversion of the womb " is occasionally met with in the chronic state," says Clarke, attended by a mucous discharge. The symptoms of the chronic state resemble those of *procidentia uteri;* and, an examination being made, a tumour is found either in the *vagina* or hanging out of the external parts. Such a tumour may be mistaken for *polypus;* but in the latter disease, the *os uteri* encircles the tumour; in inversion of the *uterus*, the *os uteri* forms a part of the tumour itself. Moreover, the inverted *uterus* is sensible; *polypi* of the *uterus*, on the contrary, are void of feeling." (p. 153.)]

1289. If the return of an inverted womb be impossible, dangerous symptoms must be prevented by properly emptying the bladder and *rectum*, by the avoidance of all effort and so on, and by the introduction of a pessary to prevent, if possible, the further descent of the womb. But if the inversion be accompanied with threatening symptoms, if the replacement be in nowise possible, if the womb be in a state of cancerous or other kind of degeneration, then may the cases related (*b*) of successful removal of the womb, determine us to its removal with the knife, after previously applying a ligature; or with the ligature, in which it is best to apply two

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(*a*) Saxtorph's gesammelte Schriften geburtshülflichen Inhaltes; translated into German by Scheel. Copenhagen, 1803, p. 305.

(*b*) Berengarii Carpi, Comment. ad Mundini Anatom., p. 225.—Dietrich, C. M., Rede von einem Vorfalle und glücklich unternommener Absetzung der Mutter. Nürnb., 1745. 4to.—Faivre; in Journal de Médecine, vol. iv.—Wrisberg, Commentatio de Uteri mox post partum naturalem resectione non lethali. Götting. 1787.—Richter's chirurg. Bibliothek., vol. viii. p. 671.—Newnham, above cited.—Windsor, J., Some Observations on Inversions of the Uterus, with a case of successful extirpation of that organ; in Med.-Chir. Trans., vol. x. p. 358.—von Siebold's Journal für Geburtshülfe, u. s. w., vol. v. pt. ii. p. 406.—Böttger, in von Graefe und Walther's Journal, vol. xxiii. pt. ii.—Kettler, in Oester. Medicinischen Jahrbüchern, vol. xi. pt. iii.—Cook, J. C., Case of Loss of the Uterus and its appendages soon after delivery; with remarks on the propriety of removing that organ in cases of Inversion or Scirrhus. London, 1836.

ligatures with a single needle and to tie them on each side to prevent slipping; it must, however, be borne in mind that the intestines may have descended in the place of the inverted womb.

[When the inverted womb falls out of the body, drawing with it the *vagina*, and increasing weakness is produced by the quantity of the discharge, "if this case is left to itself, the woman," observes Clarke, "either drags on a miserable existence for a number of years, or her life is cut short by the constant drain. Cases of this kind can receive very little benefit from external applications; and it is obvious that not much is to be expected from internal medicines. Powdered chalk or *lapis calaminaris*, sprinkled upon the part, may check the discharge a little; the oxide of zinc may in some measure abate its quantity; but it will not remove it altogether; and the same observation will apply to astringent applications generally. The following application may have a beneficial effect:—℞ *liq. calcis* ℥iv., *mucil. sem. cydon.* ℥vj. M. * * * It may be considered more prudent, if the discharge diminishes in consequence of such applications, to persevere with them, rather than to risk any danger which may arise from an operation. In those cases of inversion of the *uterus*, where the woman has passed the menstruating age, where her comfort is destroyed by the disease, and where the profuseness of the discharge threatens her with death from the debility which it produces, it may be advisable to recommend the performance of an operation, which has been in many instances attended with success, and from which the author has known a patient recover after she has attained the age of sixty; this operation is the removal of the inverted *uterus* itself. Although it is not expedient to subject a patient labouring under a chronic inversion of the *uterus* during the menstruating portion of her life, under ordinary circumstances, to the danger of the removal of the organ, the system of a woman may be so drained by the excessive discharge as to warrant the performance of the operation." (pp. 157, 58.)

It does not appear that the removal of the inverted womb by ligature is dangerous; the cases treated by Clarke himself, as well as those he quotes, did well; so also Blundell's case, and he observes:—"Indeed, I have not heard even of any cases in which the operation has been followed by fatal consequences; though such cases must, I presume, occasionally occur." (p. 145.) In one of Clarke's cases, "a strong silken ligature was used, and although nearly three weeks elapsed before the *uterus* was separated, during which symptoms of inflammatory action presented themselves in full force, with vomiting and *diarrhœa*, the result was most successful, and perfect health was restored. (p. 159.) In another, in which the operation was performed by Chevalier, "a ligature was applied round the contracted part of the tumour, that is, where the *uterus* terminated, and the *vagina* began. It was tightened daily, until about the eleventh or twelfth day, when the parts included in the ligature were absorbed, and the *uterus* fell off. During this time the patient complained of very little pain." (p. 163.) Blundell "applied the ligature with Hunter's needle, as in the case of *polypus*, and in eleven days the *uterus* came away; it sloughed, and softened down, so as not to separate bodily, in the form of *uterus*, and the recovery of the patient was complete." (p. 144.) In Dr. Joseph Clarke's case (*a*), "the pressure by ligature, which the partially inverted *uterus* bore for many days, not only with impunity, but with decided benefit to the future health, constitutes the leading feature of this case. When the *uterus* became completely inverted, its amputation became an easy operation, and the patient's previous good health suffered no diminution." (p. 161.)

Dr. Symonds of Oxford (*b*) applied a ligature in a case of inverted womb in a young woman, eighteen years of age, two years and a half after the delivery of a living child. The *placenta* had been long retained, and was brought away with great violence. The ligature was tightened every other day, and the patient did not suffer much pain till this had been several times repeated. The tumour separated on the fifteenth day; three or four days after, dangerous symptoms appeared; and on the sixth day after, she died. On *examination*, about a quart of pus was found in the *peritoneal* cavity: the' bladder and *omentum* were adherent; and there was a free and open passage between the *vagina* and the abdominal cavity, of a circular form, capable of admitting the finger, and consisting of the ring of the *os uteri*, and about three lines of the *cervix*, close upon it were the ovaries, of natural appearance, and the remains of the Fallopian tubes.

(*a*) Edinburgh Medical Annals, vol. ii. p. 419, and also quoted as above by Clarke.

(*b*) North of England Medical and Surgical Journal, vol. i. p. 149.

III.—PROLAPSE OF THE VAGINA.

(*Prolapsus Vaginæ*, Lat.; *Vorfall der Mutterscheide*, Germ.; *Chute du Vagin*, Fr.)

Schrager, Dissert. de prolapsu vaginæ uteri. Lips., 1725.

Strochlin, J. G., Dissert. de relaxatione vaginæ, prolapsu et inversione uteri. Argent., 1749.

Sabatier, above cited, p. 390.

Loder, J. C., Prog. i.–iii. de vaginæ uteri procidentiâ. Jen., 1781.

Meisner, above cited, p. 212.

Clarke, Charles, above cited, part i. p. 142.

1290. When the canal of skin which forms the *vagina* protrudes wholly or entirely from the *labia*, it is called *Prolapse of the Vagina.* It may consist either of the internal membrane alone, or of all the membranes of this canal; in the former case only is it possible for the womb not to descend at the same time. The prolapse is either *complete* or *incomplete;* in the former, the whole of the *vagina* descends; in the latter, only a part at one or other side, and usually on the front.

[The prolapse which Chelius treats of more especially, must be considered as the *anterior prolapse* of the *vagina*, and differs decidedly from the form described by Clarke, who says, "the term *procidentia vaginæ* is here meant to imply a relaxation of the posterior part of the *vagina*, so that this part is lower than the natural defined edge of the *perinæum.*" (p. 142.) From this description, it may be fairly distinguished as the *posterior prolapse* of the *vagina.*

John Burns (*a*) says, that "the *rectum*, in every degree, is more or less drawn down, and brought forward, sometimes so much so as to form a kind of pouch in the protruded *vagina.*" (p. 78.)]

1291. The *Complete Prolapse* is at first characterized by a soft bluish red, slightly wrinkled or smooth ring which, by its gradual lengthening, acquires a cylindrical form, and, at its lower end, has an aperture into which the finger may be introduced, and the mouth of the womb felt. The prolapse is increased by standing, and generally returns in the horizontal posture. If it have existed for some time, the condition of the skin is changed, it becomes dry, and similar to the common tegument; it may inflame, pass on to ulceration, and so on. Inconveniences are connected with prolapse of the *vagina* similar to those accompanying prolapse of the womb, only in a slighter degree; the patient feels, especially if the prolapse have occurred suddenly, a pressure in the *vagina*, a constant disposition to void the urine and stools; she is subject to a copious flow of whites, the menstruation becomes irregular, and on every violent exertion prolapse of the womb is to be feared. *Imperfect Prolapse* forms a blind sac, at the under end of which there is not any opening, and at the side of which the finger may be passed into the canal of the *vagina.*

The prolapse which depends on vaginal rupture, has been already mentioned (*par.* 1248.) The *diagnosis* between prolapse of the *vagina* and that of the womb is easily determined by the symptoms mentioned, by the excrescences in the *vagina*, and by examination.

["Very few symptoms attend this complaint," says Clarke; "some pain in the back is present, but this is not considerable; some transparent *mucus* comes away from the *vagina*, and the woman complains of a relaxation in the parts, and of something projecting from them." (p. 145.) "In the earlier stage," Blundell (*b*) observes, "the tumour is very small, perhaps not larger than the ball of the apex of the forefinger, forming at the back or front of the *vagina*, or laterally, or in all the three positions at

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(*a*) Principles of Midwifery. Ninth Edition.

(*b*) Above cited.

once, protrusions by no means uncommon. These protrusions, if small in size, may be looked upon as natural to the part; but they often show a disposition to increase, and then begin to attract attention." (p. 29.)]

1292. The following circumstances predispose to prolapse of the *vagina;* relaxation, and slight cohesion of the *vagina*, and its surrounding cellular tissue in cachectic subjects after a violent flow of whites, after frequent deliveries, especially if the *perinæum* be torn, after too frequent *coitus*, onanism, and the like. The occasional causes are, violent exertions in lifting heavy weights, in violent vomiting, shrieking, and the like; violent efforts in delivery, especially in improper postures, in going to stool, and so on; also pressure from the parts surrounding the *vagina*, for instance, from large stones in the urinary bladder, from retention of urine, dropsy of the belly, and so on, may produce prolapse. It arises in general suddenly or slowly.

[CLARKE's form of prolapsed *vagina* is considered by him to arise from the habitual constipation of the bowels, to which women subject themselves, in consequence of which "the lower part of the intestinal canal becomes so distended sometimes as to make the posterior part of the *vagina* approach near to the anterior part of the *pelvis*, and in this way the diameter of the *vagina* may be much diminished. This extreme distension of the gut at length diminishes, or takes off the power of contraction upon its contents, and the strength of the *sphincter* muscle is increased by its frequent resistance to the contraction of the intestines and abdominal muscles; at length, when, by the operation of purgative medicine, or by the natural strong efforts of the intestines, or by manual assistance, (which is sometimes required,) the lower bowel is emptied of its contents, the pouch formed by it, and the posterior part of the *vagina* continues, so as to form *procidentia vaginæ*. If the forefinger of the Surgeon is passed into the *anus*, under such circumstances, and carried forwards, it will be directed into the pouch so formed. This disease appears sometimes to be produced by piles, acting in the same manner as habitual costiveness. * * * The complaint may also be produced by cysts belonging to diseased ovaries, falling down into the hollow between the *rectum* and the posterior part of the *vagina*. In one case where this happened in labour, it was only "terminated by opening the child's head, by means of which operation the life of the woman was saved. After the labour, the cyst went up again into the cavity of the *abdomen*; and the *vagina* being no longer pressed down, regained its natural situation." (pp. 143, 44.) CLARKE further observes, that "when the patient is in the horizontal posture, the tumour made by the prolapsed *vagina* is somewhat smaller than when she is erect; but it never goes away altogether. Its size is sometimes as large as a hen's egg. Very few symptoms attend the complaint." (p. 145.)]

1293. A small and recent prolapse of the *vagina* is easily returned if the patient being put in the horizontal posture, on her back, with the rump raised, the protrusion be pressed back with the finger well oiled, and the skin of the *vagina* also pressed every where on the sides. If the replacement be prevented by inflammation and swelling, or the prolapse be of long standing, luke-warm baths, softening applications, a longer continued supine posture, and attention to the free voidance of the urine and stools must be employed.

[For curing the posterior prolapse, CLARKE says:—"The practitioner is to direct proper means to keep the *rectum* empty, and thus to remove one of its causes; afterwards he is to endeavour to restore the tone of the gut. Without attending to the first of these objects, the second cannot be accomplished; and unless the tone of the bowel is restored, the mere emptying of it will be useless. Purgatives given by the mouth, and clysters thrown into the *rectum*, are the means by which the first of these objects is to be attained. If piles are present, the class of resinous purgatives is to be avoided. * * * As in some instances, the gut is so much distended as entirely to have lost its power of action; neither clysters nor purgatives will be of any avail; the clyster-pipe, as it passes into the *rectum*, will be blocked up by *fæces;* and purgatives will only bring a large quantity of *fæces* down, which will add to the bulk, already too great. Nothing remains in this case but to empty the *rectum* by manual operation. * * * The patient being placed on her left side on a bed, her knees being drawn upwards, the forefinger of the right hand of the Surgeon, covered with oil, is to be introduced into the *vagina;* a marrow-spoon, or the small end of a common table-spoon, covered with oil, and warmed, is then to be introduced into the *rectum;* and by means of it, assisted by the finger in the *vagina*, the *fæces* are to be scooped away. A large clyster is then to be thrown up; and if any fæculent matter should be lying in the sigmoid flexure of the *colon*, it will be brought down into the *rectum*, where it may be easily removed. For the purpose of giving tone to the *rectum*, the same means are to be employed as are calculated to produce similar effects in other parts of the body. Bandages are not applicable to this case. The object is to give support to the posterior part of the *vagina* and to the weakened *rectum*. A globular pessary answers both of these purposes very well, and it should be carefully adapted to the size of the *vagina*. * * * Costiveness in future is to be carefully prevented." (p. 146-48.)]

1294. To prevent the reprolapse of the *vagina*, the introduction of pads filled with astringent substances, and steeped in red wine, or sponges cut in conical form, moistened with astringent fluids, should be used previous to employing the pessary. The patient must for a long time observe rest and a horizontal posture; and employ the remedies advised (*par.* 1275) for strengthening the relaxed parts. In old prolapses, which cannot in any way be kept up, the operation already mentioned in prolapse of the womb, (*par.* 1278,) by narrowing or closing the *vagina*, can alone get rid of the evil.

*III.—OF PROLAPSE OF THE BLADDER.

(*Prolapsus Vesicæ*, Lat.; *Harnblasenvorfall*, Germ.; *Chute de la Vessie*, Fr.)

Clarke C. M., above cited, part i. p. 130.

Blundell James, M.D., above cited, p. 31.

[*Prolapse of the Bladder* may be easily mistaken for prolapse of the *vagina*, and has been confused, though with less cause, with that of the womb, although some of the symptoms are common to both. The prolapsed bladder falls back, just behind its neck, carrying with it, into the cavity of the *vagina*, the front of that passage, and the two together descend less or more completely, and appear at the *os externum* in form of a convex or hemispherical swelling, which fills up the orifice, and sometimes protrudes between the *labia*, the transverse folds of the *vagina* being less or more distinct upon it, according as the bladder is full or empty.

The sensation of bearing down is less great than in prolapsed womb; but it is in some women greatest in the horizontal posture; in the night, therefore, the patient is much annoyed with this sensation, which is frequently accompanied with a perpetual desire to make water. The discomfort and protrusion is greatest when the bladder is full; but it rarely happens that that organ can be completely emptied, the muscular fibres forming the pouch or tumour not appearing to have the power of contracting completely. The peculiar symptom of prolapse of the bladder is a pain referred to the navel, with a sense of tightness there; the pain greatest when the bladder contains the largest quantity of urine, diminishing as the water is voided, and ceasing when the bladder is nearly or entirely emptied. This symptom is especially noted by Clarke, who thinks it may be accounted for, perhaps, by a stretched state of the umbilical ligament, (the remains of the umbilical arteries,) or by the dragging upon the navel itself. The pressure of the back of the bladder on the front of the *vagina* lengthens the cellular tissue, connecting it with the front of the *cervix* *uteri;* but, as it does not yield readily, it drags down with it the anterior lip of the *os uteri*, and lengthens it very much. Hence, "the *os uteri*," says Clarke, "instead of being found in the centre of the *pelvis*, opens directly backwards, and lies in contact with the posterior part of the *vagina;* so that the space between the elongated anterior lip of the *os uteri*, and the posterior part of the *vagina* is very small;" and sometimes, indeed, the *os* is patulous. There is often a discharge of *mucus* in these cases, and rarely it is profuse.

Prolapse of the bladder is distinguished from prolapsed womb, by the absence of the stomach symptoms, which rarely, if ever, occur when there is mere displacement of the bladder (Clarke.) There is not any aperture in the protruded part, as in prolapsed womb; but the swelling has a regular form, filling up more or less completely the cavity of the *vagina*, but admitting the finger to be passed up between itself and the hind wall of that passage, to the mouth of the womb. Clarke says that, on tracing the tumour in the *vagina* "to its origin, it may be felt lying between the *os pubis* before, and the *uterus* behind; and a practitioner can hardly fail to discover that it is formed by fluid." The latter part of this observation is correct; but its relative condition with regard to the womb will depend upon the extent of the dropping down of the bladder, and the position of the womb is rather above than behind the tumour. The diminution of the size of the swelling when the bladder is emptied, is also another characteristic, and distinguishes the disease from the encysted or other tumours which occasionally, though rarely, form in the neighbourhood of these parts.

If the catheter be introduced, it can be easily felt within the cavity of the swelling, (an excellent indication of the disease,) and, under voluntary urging, the swelling is found to increase considerably in size. By these two marks the disease may be readily known (Blundeel.) If the prolapse occur during labour, care must be taken not to mistake it for the descending portion of the membranes, by which irreparable mischief has been inflicted (Castle.)

The *treatment* consists in keeping the bladder constantly empty, in the injection of astringents, and in wearing a pessary, either globular, or egg-shaped. The latter is, perhaps, the most preferable, "particularly," says Clarke, "where the diameter of the *vagina* is but little increased by relaxation." All exertion which might force the bowels down upon the bladder should be avoided, and the patient should be kept quiet; and, perhaps, if confined to the recumbent posture upon her face, with a catheter in her bladder, so that the urine might pass off without being retained in the bladder, and thus the disposition of that organ to contract encouraged and kept up till the *vagina* had recovered sufficient tone to resist the pressure of the protruding bladder.

The use of the pessary and astringents is said to be generally sufficient for the cure of prolapse of the bladder; but sometimes the instrument cannot be borne, and the downward pressure of the swelling is so great and inconvenient, that the woman is incapable of any exertion, or even of moving about without much distress. Under such circumstances, it will be advisable to take out a portion of the front wall of the *vagina*, and thus diminish its disposition to yield to the pressure of the bladder.

Cases of prolapse of the bladder do not often fall under the Surgeon's care in this country, except when the ordinary treatment with pessaries and injections fail, and it becomes a question whether the patient can be relieved by an operation. One such instance has come under my care, and been considerably relieved; for, although not entirely cured, the patient has been enabled to resume her ordinary occupation.

Case.—M. A., aged twenty-five years, a fair-haired, hysterical, well-formed, but not stout single woman, came under my care,

Oct. 24, 1837.—She began to menstruate when sixteen years old, and for the first year had good health; but since that period has been continually ailing, and suffered very much at her monthly times. The menstrual discharge has been scanty, and not lasting more than two days, when she has been so unwell as to be quiet; but, when engaged in her occupation as housemaid, and able to be about, it has been plentiful, and lasted four days. She has always had much bearing down, and, within the last three or four years, has suffered much from *leucorrhœa*, and the bearing down has so increased, that, for the last twelvemonth, she has been unable to follow her usual employment, and been compelled to give up her place. Five months ago the protrusion was as large as a cowrie-shell, and, when she exerted herself, it became much larger. She did not usually void her urine for twelve or sixteen hours, and then the protrusion disappeared. Micturition was always accompanied with sharp smarting pain; it was long before she could void any water; sometimes not for eighteen or twenty hours. By repeated efforts, however, she was at last enabled to empty her bladder, and never required the introduction of a catheter. Last spring she attempted wearing an Indian rubber pear-shaped pessary; but it was useless, as, whenever she walked about, it immediately dropped out. For the last three months she has kept in bed, used astringent injections, and worn a sponge pessary, which has kept the swelling up, but without any actual improvement.

Nov. 11.—I made an examination with the view of ascertaining the feasibility of removing some horizontal slips of the front of the *vagina*, as suggested to me by my friend Dr. Locock. As she had not made water for three hours, the bladder was partially filled, and a swelling, about the size of a cowrie, protruded through the *os externum vaginæ*, and just appeared in front of the *furcula*. Some of the *rugæ* of the *vagina* were very distinct, and the swelling began a full inch behind the orifice of the *meatus*, which canal was not at all displaced, and allowed the ready entrance of a catheter into the bladder. Slight pressure returned the tumour, and the *os uteri* was then found depressed to within an inch of the *os externum*. On expanding the *vagina* with the *speculum*, it was seen to be so drawn off from the front of the neck of the womb, that no appearance of neck remained; but from the plane of the *os uteri* to the front wall of the *vagina*, was one continuous and very open curve; but the *cul-de-sac*, behind the neck, was, on the contrary, very deep. Having withdrawn the *speculum*, I could, without difficulty, nip up an inch and a half of the *vagina* from the back of the bladder; and having ascertained this, it was determined to remove a slip or two of the lax part.

Nov. 12.—Having bound her, and put her in a position for lithotomy, as there was but little protrusion, and her efforts failed of driving the swelling down, I commenced the operation by pinching up the front of the *vagina*, and passing a *tenaculum* through, drew it down; I then introduced a needle and ligature, about an inch below the *os uteri*, and half an inch above the *tenaculum*, for the purpose of drawing down the *vagina* after the removal of the proposed slip, and to prevent difficulty from its retraction. The portion of the *vagina* included on the *tenaculum* was then drawn down, and having been felt to be separated from the bladder, I made a horizontal cut, about an inch and a half in length, carefully separated the *vagina* from the bladder, first with the blade, and after with the handle of the knife, till I could hold the slip with my thumb and finger, and withdrew the *tenaculum*. I then separated the flap till it was an inch in depth at the middle, but tapering to a point at each end, and cut it off horizontally below with a pair of scissors. There was pretty free bleeding, but only one small vessel could be found to tie, and it ceased after sponging with cold water for about a quarter of an hour. I then introduced three platina sutures upon very small needles, the middle one first, and having brought the edges of the wound close, twisted them together. She was then put to bed upon her face, a catheter introduced, and the urine directed to be withdrawn hourly. The operation was not difficult, nor very painful; but there was a little awkwardness in getting the sutures through, perhaps from the small size of the needles.

Nov. 13—Last evening there had been a little oozing of blood; but during the night a considerably quantity; one sheet having been soaked through, has been removed, a second is in much the same state, and there is about eight ounces of clot in the hair of the *pubes*. She feels rather faint, but her face is much flushed. She has passed plenty of water, both through and by the side of the catheter; but she complains of much pain in the chest and loins, with great tenderness of the belly.

As it did not seem well to permit the continuance of the bleeding, I removed the catheter, cleared away all the clot, and introduced the *speculum.* No clot was found in the *vagina*, but there was a free oozing from between the lips of the wound. Failing to find any vessel, I removed the right suture, upon which the wound gaped, and seizing its upper lip, whilst she strained, I drew it down, and carefully examined the whole surface, from which the oozing was very free. After considerable trouble, I found and tied three small bleeding vessels, which, however, I believed to be veins, and the bleeding being checked, I passed a silk suture, and again introduced the catheter.

Nov. 15.—She has not had any more bleeding, and the pain and tenderness of the belly have diminished, but the latter still continues about the region of the bladder. There is a little fetid discharge from the *vagina*, and some small thin flakes of adhesive matter in the urine. On examining with the *speculum*, I found all the sutures had begun to ulcerate, and therefore removed them; the metallic ones with some difficulty, as they did not readily untwist. The wound did not gape, but the extent of the union could not be ascertained. On the front of the *vagina*, near the neck of the womb, was a seemingly ulcerated spot, perhaps where the first thread for drawing down had been passed.

She had a tolerably good night, and next morning drew off about half a pint of very ammoniacal urine, with much adhesive flakes; this evacuation was followed with great pain in the bladder and *pudendum*, for about half an hour, and then gradually subsided. In the course of the day, the quantity of water drawn off increased, and became quite clear. She had not any febrile excitement, but still complained of much pain in the left breast, across the pit of the stomach, and over the whole belly, which is probably only hysterical. She had an increase of the throbbing in the wound, which has been constant since the operation.

Nov. 17—The throbbing has diminished, and the discharge from the *vagina* has increased, and is distinctly purulent. She has still much pain in the region of the bladder, and the urine is much loaded with adhesive matter.

Nov. 19.—Is better, and has passed plenty of urine, which yesterday was scanty, and the sediment in it mucoid. Less throbbing in the *vagina*, but the discharge increased. Complained of pain and soreness, with beating in the umbilical region, and some tenderness on pressure, as also about the region of the bladder; and also pain in the upper part of the thigh. Her bowels are kept regular with castor oil. In the course of the evening she became very hysterical, and it was necessary to give her some æther and tincture of henbane, with camphor mixture. But next day she had recovered herself, and her bowels having been freely moved, the abdominal pain almost entirely ceased.

Nov. 22.—The *speculum* was introduced to examine the state of the parts, but being inefficient, was withdrawn, and the *os externum* being held widely apart with the fingers, she was desired to bear down. This brought the wound into view, which had not yet united, but was healing by granulation. There was a free *leucorrhœa.*

Jan. 6, 1838.—Up to the present time, she has been kept in bed, and the wound has healed. The discharge continues very profuse, and she has much pain in the loins. On examination, the bladder was found still falling back, as previous to the operation.

A fortnight after, she was allowed to get up and walk about; the descent of the bladder soon became as at first, and protruding between the *labia* when she exerted herself. The operation had therefore been unavailing. In the middle of *March*, after going about more than usual, the bladder protruded to the size of an egg, and on the following day still more; but a few days rest in the recumbent posture restored the old condition.

As she continued very delicate, it was determined she should go to the sea-side for the improvement of her constitutional powers, and she went to Brighton in *April*, wearing a globular pessary, which kept the bladder up; but after a month, as it caused much pain in the region of the bladder, it was thought advisable to remove it, which was done with much difficulty, and in course of the following week the protrusion returned. For some weeks she used a cold salt water hip-bath daily, and the recumbent posture; and afterwards, sea-bathing three or four times a week, but without diminution of the discharge, and with no benefit to her health.

The *vagina* was then cauterized with the caustic potash thrice, at intervals of a week; from the first application there was little sloughing, the second caused much, and the third less, but more than the first; and during the separation of the sloughs, she used injections of cold sea water continually, and took forty drops of the tincture of muriate of iron twice a day. She left Brighton in *September* without any material improvement, and returned home to her usual employment. Soon after, the dragging pain in her loins and the protrusion increased, and if she walked a short distance, these became worse, and were accompanied with pain in the upper part of both thighs. In *December*, a ring pessary was introduced to relieve the protrusion, but its pressure upon the *rectum* was so great, that she could not pass her motions, and after having been worn three days, it was necessary it should be removed.

She came under my care again in *January*, 1839, much out of health and spirits; nothing therefore was done but to improve these, and I did not make any examination till the middle of *April*. The bladder was then still fallen, but less than before, merely appearing at the *os externum*, and returned with the least pressure with the fingers; the scar on the front of the *vagina*, of which the shortening was very decided, was quite visible, and though not hard was tender; the position of the womb and the state of its lip was nearly the same as at first. Thinking, as little pressure kept the bladder in place, a small oval pessary might be useful, I introduced one; but the next day the bladder had slipped down between it and the *pubes*, and she had so much pain that it was necessary to remove it.

Although kept in the recumbent posture, she still had severe dragging pain in the loins, equally as when she was about; and as she objected to the application of caustic again, but was willing to submit to an operation, I determined on removing a vertical piece of the *vagina*, which was done

May 18.—She was now placed standing with her body bent at right angle with her legs, and resting upon a table, with the *pelvis* rather higher than the shoulders. A pewter *speculum*, slit lengthways and the edges widely opened, was introduced into the *vagina*, with the gap towards its front; a catheter was introduced; the *labia* held apart by assistants, and the *perinæum* pressed up with the *speculum*. I then seized the front of the *vagina* with Beaumont's needle and drew it down till I could conveniently pass a *tenaculum* through it, which done, the needle was withdrawn. Pulling up the *vagina* with the *tenaculum* as far as I could, I cautiously made two semi-elliptical cuts about an inch and a half in length, from half an inch below the neck of the womb to about the same distance behind the *urethra*. The right cut was made freely with a common scalpel, but the left required a little more care and was made by short portions, cutting upwards with a *phimosis* knife which was very convenient; and the insulated piece was then dissected off the bladder, leaving a gap about half an inch wide, which was increased to an inch by paring the edges of the wound. There was, as in the former operation, very free oozing of blood, and it became necessary to tie two small arteries. Three sutures were put in very readily with Beaumont's needle, and the *speculum* having been withdrawn they were tied and the operation completed. She was put to bed on her face, and an elastic male catheter introduced, so that the urine might escape as soon as it entered the bladder; and twenty drops of laudanum, thrice a day in mint water, were ordered for the purpose of keeping the bowels costive.

May 23.—Excepting a little discomfort from position, she has been tolerably well. There is now a little purulent discharge, and on gently separating the parts one suture was found separated, but there was little inflammation about the wound.

May 26.—She was rather flushed and feverish, and had not passed water for some hours; the catheter was withdrawn, found to be clogged, and when introduced again, a pint of high-coloured urine passed, which greatly relieved her. Another suture and one of the ligatures came away in the evening, and on the following day the remaining suture and ligature.

June 7.—The catheter having caused some irritation to the bladder, was removed, and a common female instrument given her to pass frequently, so as to prevent distension of the bladder. Up to this time the urine has been more or less turbid, with flakes of adhesive matter, as after the first operation.

June 18.—Having now been on her face for thirty-one days, latterly without much inconvenience, she was allowed to lie on her side.

July 22.—An examination was made; there was less protrusion, but the bladder still falls back into the *vagina*. The wound is perfectly healed; but there is tenderness about the neck of the bladder. The discharge continuing, a small bag partially filled with powdered oak bark was introduced into the *vagina*. The bark swelled so much with the moisture that it was necessary to diminish its quantity.

Aug. 5.—The discharge is materially diminished, but the *vagina* slips below the bag.

Aug. 25.—Was allowed to dress herself, but still kept in the recumbent posture. The bark bags were left off, and a saturated solution of alum in elm bark was ordered to be injected frequently during the day.

Sept. 5.—She has not gained much advantage by the injection; the bladder is just visible at the *furcula*.

Sept. 20.—She returned home, being able to walk about much better than previous to the operation, and had but little pain in the loins; the discharge, however, continued. She was directed to wear a pad in the *perinæum*, supporting it with a T bandage, and to use the oak-bark bags.

On the whole I was fearful that she had not derived any material benefit by the operations to which she had been subjected, but was agreeably surprised on seeing her in

November, 1840, to learn that soon after her return home, she had been able to stand whole days at the ironing-table without any protrusion. For some months she has been able to go about without difficulty, and do anything she has to do; but she says there is some protrusion. I examined her, however, and found little or none.

In the following *January* she married, and was confined in the ensuing *December*. She was taken in labour on the 16*th*, and delivered after forty-eight hours. She got up at the week's end, and a week after there was protrusion about the size of a walnut, which continued increasing till at present, *March* 20, 1842.—The bladder again protrudes between the *labia*, about the size of a crown piece; after standing up, the mouth of the womb descends behind; but both easily return when she lies down. Her health is now tolerable, and she manages with a little weariness to get through the usual occupations of a labourer's wife.

As with all the disadvantages which her continual standing whilst at the ironing board, the protrusion had been materially checked, and as she was capable of exertion which for some years before she was incapable of making, it may be inferred that the latter operation was advantageous to her, and that probably had she kept quiet at first for some months, she would have recovered completely. I should not hesitate therefore to perform this operation in a similar case.—J. F. S.

Lightfoot of Newcastle-on-Tyne (*a*) has performed successfully Fricke's operation of episioraphy in a case of prolapsed bladder which descended through the *labia* to the size of a fist. Six strong hempen sutures were put in; the limbs tied together, and the woman put on her side; a catheter was introduced, and not removed for two days; but the urine being found to escape by its side, and cause irritation, it was removed, and passed occasionally for the following five or six days. Cold water was applied, and the *vagina* now and then cleared and washed by injecting cold water. Opium was given to constipate the bowels. Two of the sutures were taken out on the fourth, and the others on the sixth day, at which time union by the first intention was complete. Three weeks after the operation she left her bed, and walked about; and in a week after, she was able to resume her usual occupation of household work. On examining her three weeks after, there was not the slightest prolapse; and when she was desired to strain violently, the *rugæ* of the *vagina* were seen, but did not protrude.]

IV.—OF PROLAPSE OF THE RECTUM.

(*Prolapsus Ani*, Lat.; *Vorfall des Mastdarmes*, Germ.; *Chute du Rectum*, Fr.)

Schacher, Dissert. de morbis a situ intestinorum naturali. Lips., 1721.

Luther, Dissert. de procidentiâ ani. Erf., 1732.

Heister, Dissert. recti prolapsus anatome. Helmst., 1734.

Monteggia, Fasciculi pathologici. Turin, 1793, p. 91.

Jordan, Dissert. de prolapsu ex ano. Göttingen, 1793.

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Howship, J., Practical Observations on the symptoms, discrimination, and treatment of some of the most common Diseases of the Lower Intestines and Anus, &c. &c. London, 1820. 8vo. Chap. iv.

(*a*) Lancet, vol. i. p. 322. 1841.

BUSHE, GEORGE, M.D., A Treatise on the Malformations, Injuries, and Diseases of the Rectum and Anus. New York, 1827. 8vo.

SYME, JAMES, On Diseases of the Rectum. Edinburgh, 1828. 8vo.

SALMON, FREDERICK, Practical Observations on Prolapsus of the Rectum. London, 1831. 8vo.

DUPUYTREN, Le Baron, Leçons Orales de Clinique Chirurgicale. Article,—*Chute du Rectum*, vol. i. p. 157. Paris, 1831.

MAYO, HERBERT, Observations on Injuries and Diseases of the Rectum. London, 1833. 8vo.

BRODIE, Sir BENJAMIN C., Lectures on Diseases of the Rectum; in London Medical Gazette, vol. xv. p. 845. 1835.

VELPEAU, Leçons Orales de Clinique Chirurgicale. Article,—*Procidence de l'Anus*, vol. iii. p. 128. Paris, 1841. 8vo.

1295. *Prolapse of the Rectum* appears under three forms; it may be either the *rectum* with all its membranes, or simply the internal membrane, or an inverted upper portion of the intestine (*Volvulus*, *Intussusceptio.*)

Although the *rectum* is pretty firmly fixed in its place, its prolapse, with all its membranes, has been improperly doubted; it occurs rarely under this form, but I have distinctly noticed it (1).

[(1) The opinion here disputed is COPELAND's, who says:—"In almost every case of *prolapsus ani*, it is the *internal* membrane of the intestine only which descends through the *sphincter* muscle. The connexion of the external surface of the *rectum* is so firm with the surrounding parts, that it is almost impossible the whole should be protruded together; a separation or elongation of the union between the coats of the intestine must therefore precede the disease, and forms its essential character; whether it be produced by the effusion of blood between them, or by continued *tenesmus*, or efforts to pass the *fæces*, or peculiarity of structure, or any other cause." (pp. 74, 5.)

SYME does not agree with either CHELIUS or COPELAND, as to what he calls *prolapsus ani*. He says:—"Such tumours consist either of the gut in its whole thickness, or of the mucous membrane alone in a state of morbid development. Being thus differently constituted, they should not be confounded together, as they usually are, but carefully distinguished, since they have no resemblance to each other, either in the nature of their production, or the treatment which they require. In making this distinction, it is fortunately unnecessary to employ any new names, since if the title *prolapsus* be confined to denote those protrusions in which the whole thickness of the gut is concerned, the other forms of the disease may all be referred to the head of Hæmorrhoids." (pp. 88, 9.)

BUSHE describes only "two forms of this disease. In one the mucous membrane is alone prolapsed; whereas, in the other, all the coats of the *rectum* come down. The first is by far the most common, in consequence of the great extent and loose connexion of the mucous tunic; while the firm union of the intestine itself, with the surrounding parts, the longitudinal direction of its strongest and most numerous fibres, together with the action of the *levatores ani* muscles, offer much resistance to the descent of the entire gut." (p. 201.)

That cases do occur in which the whole gut is prolapsed, is put beyond all doubt, as VELPEAU mentions, that "the younger BÉRARD dissected a tumour formed by invagination of the *rectum* through the *anus* of a female. The inversion of the intestine was complete, for the *peritoneum* was included in the swelling." (p. 128.) He also mentions PAILLLARD's case (*a*) and others cited by NELATON.]

1296. In the prolapse of the internal coat of the *rectum*, consequent on relaxation and lengthening, merely a little reddish swelling first appears, which gradually enlarges, increases in size, becomes wider, is rounded below, but narrowed above by the *sphincter* muscle, and at its free extremity has an aperture by which the stools escape. The surface of the prolapse is, according to its different duration, and the degree of its

(*a*) Révue Médicale.

girting by the *sphincter*, red, bluish, more or less tense or soft, covered with bloody mucus, and often divided into several lobes (1).

In prolapse of the *rectum*, with all its coats, which I have only noticed in children, a more cellular swelling, which terminates pretty pointedly, projects directly, as in protrusion of the bowel from artificial *anus;* and if the finger be introduced through the opening, the contraction of the intestinal walls is distinctly felt (2).

The symptoms which prolapse of the *rectum* especially produce, are various, according to its degree and duration, but generally they are not severe, because the *rectum* is not so very sensitive to the contact of air. If, however, the prolapse be considerable, it may inflame or become strangulated by violent contraction of the *sphincter* muscle, in which case even gangrene may occur (3).

[(1) "When the mucous membrane is alone prolapsed in the child, it assumes," says Bushe, "the appearance of a small pyramidal, red and coiled tumour; while in the adult it is less red, and generally takes the form, either of two lateral flaps, or of a circular fold. In some of these cases, the portion of membrane thus protruded comes from the pouch of the *rectum*, while that within the sphincters remains *in situ*. When this is the case, we can pass the extremity of the little finger between that portion of the membrane which adheres to the internal *sphincter* and that which is protruded." (p. 204.)

(2) Syme's *prolapsus ani*, in which the whole thickness of the gut is involved, "consists of a tumour generally round or oval, but sometimes cylindrical, varying in size from that of a small egg to that of the largest orange, exhibiting the slimy surface of a mucous membrane, and affording a copious secretion of very similar appearance to red currant jelly. It is obvious that the connexions of the lower part of the *rectum* must prevent it from descending, so as to present these appearances, which can be accounted for only by supposing that the higher part of the gut becomes invaginated in the portion below it, so as to project beyond the *anus*. In short, the derangement will be the same as that which is named *intussusception*, with this difference, that, in the latter case, the invagination occurs higher up the intestine, beyond the reach of sight and touch." (p. 89.)

(3) "The symptoms of the *prolapsus*," observes Syme, "vary with the size of the part protruded, and the degree of vigour with which the intestine resents its unnatural position. They are, therefore, in general, more urgent in young persons, and less so in old people. There is always more or less uneasiness in the protruded part, and obstruction to the evacuation of the bowels; and, if inflammation commences, the sufferings of the patient become extreme, terminating even in his death, or mortification of the invaginated portion of intestine. Though the bad consequences are not always very rapid in their progress, the disease, if left to itself, can never be regarded as free from danger, and should, therefore, always be remedied as soon as possible." (pp. 91, 2.) Bushe also remarks that, "when the protrusion is allowed to remain down, it becomes engorged with blood from the pressure which the *sphincter* exercises on the veins, as is manifested by its increase in size and livid colour. If it be not soon reduced, inflammation sets in, and is attended not only with great local pain, but fever, and, in some rare cases, death ensues, in consequence of extensive peritoneal inflammation. In some other, and yet more rare cases, the protruding portion sloughs off, and a cure follows." (pp. 204, 205.) A case of the latter kind is related by Sauveur and Ansiaux (*a*).

Prolapse of the *rectum* is liable to be confounded with hæmorrhoidal tumours, and with *intussusception*. Copeland says "the *prolapsus ani* has so many points of analogy with hæmorrhoids, that it may, in some measure, be considered as the same disease in a more chronic and advanced state." (p. 73.) And Syme thinks that the protrusion of the mucous membrane alone should be referred to the head of hæmorrhoids. Bushe observes, as to its *diagnosis* from hæmorrhoidal tumours, that "the semilunar form of the flaps, the extent of their base, our ability to glide the folded membrane between the finger and thumb, as well as their freedom from erection and hæmorrhage, are characters so opposite to those which pertain to hæmorrhoidal tumours, that a very cursory examination enables us to distinguish them." (p. 162.) In reference to *intussusception*, he says:—"In protrusion of the *rectum*, we are not able to insert a probe or the finger higher than the border of the internal *sphincter*, in consequence of the doubling of the mucous membrane; while, in *intussusception*, no resistance is offered to the ascent of either one or the other." (pp. 205, 206.)]

(*a*) Ansiaux, N., Clinique Chirurgicale. Second Edition, p 179.

1297. The causes of this prolapse are either injuries which weaken the sphincter muscle and the natural attachments of the *rectum*, as infrequent hard evacuations from the bowels, the improper use of relaxing clysters or strainings, which drive the intestine down, as severe and continued bearings down in long continued *diarrhœa*, ascarides, hæmorrhoidal inconveniences, organic changes of the membranes of the *rectum*, stone in the bladder ; further, violent screaming and attempts at raising heavy weights, and the like. Rectal prolapse occurs most commonly in children, especially from *diarrhœa* during teething, and in old weakly subjects.

1298. Prolapse of the *rectum* is always a painful ailment. In children, it is for the most part, soon cured, if the causes of irritation of the *rectum* be removed, and more power obtained by the continued development of the sphincter muscle. In grown persons the disease is always more severe, and easily returns upon every occasion. In old prolapses considerable changes occur in the structure of the *rectum*, continued discharge of *mucus*, and the like, occur (1).

[(1) "When the descent of the bowel is often repeated," says Bushe, "the mucous membrane becomes indurated, loses its villous surface, and, in some instances, even ulcerates. This is more likely to be the case when the *sphincter* has become relaxed, from the repeated dilatation it has suffered, and there is a constant *nisus*, causing the bowel to contract, and force out the mucous membrane." (p. 205.)]

1299. The *treatment* consists in the reduction and keeping up of the prolapse and upon the removal of its causes.

For its replacement, if the prolapse be recent and small, slight pressure with the flat of the hand is sufficient ; but if it be considerable and have existed many hours, the patient must be placed, after having voided his urine, upon his belly, with the rump somewhat raised, and the thighs separated ; or he must be put upon his knees and elbows, and then with the finger smeared with oil, placed near the opening of the *rectum*, it must be attempted to press back alternately the part of the bowel nearest the opening, during which the patient should refrain from all forcing and shrieking. If in this way the prolapse be returned into the cavity of the *rectum*, it must be attempted by the introduction of the finger to carry it higher and into its original situation (1). If the prolapse be large, of many inches length, and consisting of all the coats, especially in children, the practice just recommended for its return is insufficient. The forefinger of the right hand must be introduced into the opening of the prolapse, with which the prolapsed part is to be thrust in and then kept up with the fingers of the left hand, placed at the edge ; the forefinger is to be somewhat withdrawn, and again introduced deeper, so as by repeated thrusting inwards to return the prolapse. If the reduction be very difficult, in consequence of spasmodic forcing, relaxing antispasmodic applications, opium internally and in clysters, are useful. If the prolapse be girt by the *sphincter* muscle, and much inflamed and swollen, its return must be attempted after the use of blood-letting and cold applications. Some persons recommend also slight cuts (2). If this do not succeed and symptoms of danger ensue, the *sphincter* muscle must be divided at that part where the stricture is greatest, by means of a director introduced into it, and a button-ended bistoury, which is advantageously preceded by the use of a *speculum ani*. If the bowel still cannot, on account of the great swelling, be reduced, it must be only gradually returned, as it is diminished by the use of proper remedies.

[(1) The plan recommended by Brodie for the treatment of prolapsed *rectum* in children is the following:—"Purge him with calomel and rhubarb occasionally; be very careful about his diet, that he does not eat a great quantity of vegetable substance, which tends to fill up the cavity of the bowel, while it affords but little nourishment, and every morning let some astringent injection be thrown up. That which I have generally used is a drachm of *tinct. ferr. mur.* in a pint of water, and two or three ounces or more of this, according to the age of the patient, may be injected into the *rectum* every morning, the child being made to retain it as long as possible. I never saw a case of *prolapsus* of the *rectum* in a child which was not cured in this manner." (pp. 845, 46.)

The treatment of prolapsed *rectum* in children, in whom it is frequently of considerable length, is a very troublesome matter. The attempt to reduce it gives the child pain, and causes him to cry, and thus force the bowel down repeatedly almost directly after its return, the relaxation of the *sphincter* being so great, in general, that it affords little opposition to the descent of the gut. I have not been in the habit of using injections; but have merely kept the child as much as possible in the horizontal posture, and, having returned the bowel, have applied a pad either of linen alone, or of cork covered with linen, and of corresponding size to the breadth of the protruded gut, fastening it with a T bandage. If the protrusion can be only a little restrained at first, it is pretty certain that continuing the same remedy will ultimately be effective, although but very slowly. Attention to the bowels, so that the stools should be thin, and passed with little effort, is a very important part of the proceeding; and for this purpose I prefer a tea-spoonful of castor oil occasionally, which I think better than calomel, as less likely to produce the *tenesmus* so frequently following the use of that medicine. The nurse, however, must be taught how to return the gut, and strictly enjoined to return it immediately after the motion has been passed, and not to allow the child to sit straining on his chair, as is too commonly permitted.—J. F. S.

(2) DUPUYTREN, with great propriety, objects to this practice. He says:—"Some persons recommend scarifications; but, as they cause wounds, and consequently inflammation of the large bowel, they should not, as far as possible, be employed. The same objection applies to leeches, which may produce internal or external bleeding, and ulceration of the gut." (p. 159.)]

1300. In order to prevent the reprolapse, it must be endeavoured to get rid, as far as possible, of the causes upon which the disease depends, to diminish the irritation of the *rectum*, the bladder, or neighbouring parts, to extirpate hæmorrhoids and the like (1), and to restore to the *rectum* its natural powers by cold bathing, by cold or astringent clysters of red wine, and the like. To prevent the reprolapse, a piece of sponge dipped in cold water, is fastened with a T bandage, or the application of large strips of adhesive plaster, from the region of the *pubes*, near to the aperture of the *anus* up to the region of the rump-bone, so that merely a space is left for the passage of the stools (*a*); the bandages of JUVILLE (*b*) and GOOCH (*c*), are to be preferred, as most suitable; as also the application of a pad of lint, in such way as not to prevent the discharge of the stools, a hollow cylinder of ivory or of caoutchouc, by which it is hoped to keep the relaxed walls in their proper place, but which generally cannot be worn, and still further weakens the *sphincter*. In women, the prolapse of the *rectum* may be kept back by a pessary introduced into the *vagina*, only it must not press either too much or too little upon the *rectum*.

KLEIN (*d*) recommends, as a very efficient remedy, even in very old prolapses of the *rectum*, sprinkling a powder, consisting of equal parts of gum arabic and *colophonium*; by the use of which the prolapse returns, and this is to be repeated as often as the prolapse recurs. I have not, however, noticed any particular benefit from it. SCHWARZ (*e*) recommends the extract of *nux vomica*, as a very efficient remedy in all cases of *prolapsus ani*, one to two grains dissolved in two drachms of water, of which from six to ten drops are to be given every four hours to children; and to older persons, even fifteen drops; frequently he gives it in connexion with some grains of extract of rhatany.

(*a*) NIEMANN, in KNESCKE's Summarium, vol. x. pt. vi.

(*b*) Abhandlung, ueber die Bruchbänder, u. s. w. p. 102, pl. xii.

(*c*) HOFER, Lehrsätze des chirurgischen Verbandes, vol. ii. p. 384. pl. xvi. fasc. 100.

(*d*) Heidelberger klinische Annalen, vol. ii. pt. i. p. 110.

(*e*) HUFELAND's Journal, 1835, Feb. No. 4.

[(1) When an adult labours under prolapse of the *rectum*, "consequent on a protrusion of piles, the first thing to be done," says BRODIE, "is to destroy the piles. Let the patient sit on a pan of hot water, and the *sphincter* muscle being relaxed, and the parts distended with blood, the piles and *rectum* will all protrude together. You must then tie the piles, which you can easily do, your assistant holding the *rectum* on one side, while you apply the needles and ligatures on the other. Having tied the piles, you return the *rectum* into its proper place; and you will probably find that, in curing the piles, you have also remedied the *prolapsus* of the bowel; but, if the patient neglects himself afterwards, as the piles return, so the *prolapsus* returns with them." (p. 846.)]

1301. All these modes of treatment are, for prolapse of long standing, really fruitless, and accompanied with considerable inconvenience to the patient (1). In these cases, the treatment prescribed by DUPUYTREN (*a*) is most effective; the patient is put upon his belly, his head and shoulders low, but his *pelvis* on the contrary much raised by one or several pillows, for the purpose of rendering the aperture of the *anus* more distinct. Two, three, four, five, or six, of the radiating folds surrounding the *anus*, which are either level, or more or less prominent, are to be seized with a pair of pincers, with somewhat flattened points, one after another, right and left, and even before and behind, and each fold, as raised, is to be taken off with scissors curved towards the surface, and the cut is then to be continued to the *anus*, or even higher into it; but it is ordinarily necessary only to continue the cut some lines upwards. In less relaxation, two cuts, in greater relaxation, several cuts are to be made on each side. Bleeding and other symptoms do not come on; but usually during the operation there is violent contraction of the *sphincter*. The wound is to be simply treated, and after scarring, the opening of the *anus* has proper firmness, and the prolapse does not recur (2).

The application of the actual cautery, according to PHILLIPS (*b*), corresponds in its operation to excision: according to the state of the case, from one to four applications must be made; and indeed, if the disease be recent, it may be merely applied to the edge of the *anus*, without touching the mucous membrane of the *rectum*; but if the case be old, the white-heated iron must be carried over the mucous membrane. The length of the slough should be half an inch. Scarring produces such contraction of the *anus*, that reprolapse is thereby prevented.

[(1) The difficulty, and even impossibility, of returning the bowel sometimes occurring in old prolapse of the *rectum*, does not depend on the contraction of the *sphincter*, as might be supposed. This was first noticed by HEY, who observes:—"Although the prolapsed part of the intestine consisted of the whole inferior extremity of the *rectum*, and was of considerable bulk, yet the impediment to the reduction did not arise from the stricture of the *sphincter ani*, for I could introduce my finger with ease during the *procidentia*; but it seemed to arise from the relaxed state of the lowest part of the intestine and of the cellular membrane which connects it with the surrounding parts." (p. 424.)

(2) It has been disputed whether DUPUYTREN is to be considered as the originator of this operation, or whether it is merely a modification of HEY's. There can be no doubt that the principle was the same, that of diminishing the aperture of the *anus*; but the two operations differ from each other as much as COPELAND's presently to be described, and far preferable to either, differs from both. HEY's account of his operation will show its total difference from DUPUYTREN's; and that able French Surgeon is fully entitled to the merit of whatever credit belongs to its proposal; although I must confess I think COPELAND's operation is best of the three recommended. HEY says:—"The relaxed state of the part which came down at every evacuation, and the want of sufficient stricture in the *sphincter ani*, satisfied me that it was impossible to afford any effectual relief to my patient, unless I could bring about a more firm adhesion to the

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(*a*) Above cited, p. 163.—Journal Général de Médecine, vol. lxxxi.—VON GRAEFE und VON WALTHER's Journal, vol. v. pt. iii. p. 524.—VON AMMON, Erfahrungen und Bemerkungen über DUPUYTREN's Operations'-methode, den Mastdarmvorfall zu beseitigen; in HECKER's Annalen, March, 1829, p. 261.—MACFARLANE, J., Clinical of the Surgical Practice. Glasgow, 1832. p. 151.

(*b*) London Medical Gazette, vol. xi. p. 384.

surrounding cellular membrane, and increase the proper action of the *sphincter*. Nothing seemed so likely to effect these purposes, as the removal of the pendulous flap and other protuberances, which surrounded the *anus*. I hoped the inflammation caused by this operation would produce a more firm adhesion of the *rectum* to the surrounding cellular substance; and I could not doubt that the circular wound would bring on a greater stricture in the *sphincter ani*." (pp. 443, 44.)

It is not out of place to remark in reference to these operations, that VELPEAU observes:—"Very frequently a portion of the fleshy coat of the intestine is found accompanying the mucous coat in prolapsed *rectum*. There is no inconvenience in removing with the mucous membrane a portion of the muscular tissue; on the contrary, the cure will be more complete, and I have some disposition to believe that the want of success which has occasionally followed the operation has depended on the omission of this precaution." (p. 135.)

The only means of "restoring the disturbed union between the inner membrane of the intestine and its external surface," is, according to COPELAND, "by exciting a degree of inflammation on the *external* surface of the inner membrane, sufficient to produce an union and consolidation of the parts together." He objects to the use of stimulating injections, as inflaming the mucous surface, causing great pain and distress, "without any material benefit to the disease; for the inflammation is propagated along the mucous surface, without extending to the deeper seated parts or external coat of the intestine." Having shown that the inner coat of the alimentary canal loses a considerable portion of its villous nature as it approaches its extremities, that wounds at such points are less serious than when inflicted on the more interior portions of the canal, and that "the degree of pain is beyond all comparison, less in proportion as the part wounded or tied is more removed from the *anus* and the *cutis* surrounding it; an operation or ligature which would be violently painful at the circumference of the *anus* if it involve the smallest portion of the skin, being spoken of as little more than uneasiness, or not calling forth any expression of pain, when performed on a part of the membrane more removed from the seat of external sensation; and the consequent fever and inflammation having the same relation to the part," he proceeds to observe, that "the only effectual means then of producing this desirable union between the coats of the intestine, is by a wound, or a removal of a small part of the inner membrane which protrudes at the *anus*, and constitutes the disease." * * * That the removal of the (entire) protruded portion is not very essential to the cure of the disease, I think will appear evident, if it be considered how very small a part of the inner membrane being cut or tied away, in proportion to the whole bulk, will be sufficient to prevent the remainder from protruding. I have, in some instances, been obliged to repeat the operation on the opposite side of the gut, when the adhesion formed by the wound was not sufficient to support the whole circumference of the canal. But in one case I removed the ligature immediately after it had been very tightly applied, and returned the intestine. The cure was complete; but I do not know whether the part sloughed or not to which the ligature had been applied. This injury done to the inner membrane of the intestine, then, is the most certain mode of producing that degree of inflammation, and consequent adhesion, which produces the cure of the disease, and in which, in fact, the cure consists.

"The mode of performing the operation which I think is most advisable, and which I have very frequently performed without any one unfavourable circumstance, is, the bowels being well emptied previously, and the time chosen when the projection is considerable, to pass a tight ligature round a very small portion of the inner membrane, at a part not immediately in the vicinity of the *anus*, that is, above the union of the *cutis* with the mucous membrane, and to return it, together with the ligature, into the gut. This is not, for the most part, a painful operation; but it is advisable that a grain of opium, or a few drops of laudanum, be given to procure ease, and also that the bowels may be somewhat confined for a day or two after the operation; for an evacuation during the active stage of the inflammation would give considerable uneasiness, and interrupt the adhesions which we depend on for the cure. Nevertheless, the cure has not been less complete, because the parts have come down in a more swelled and painful state for several days after the operation. The patient must be directed to keep his bed, should live very sparingly, and cloths dipped in GOULARD water, or laudanum and water, should be applied when the pain or inflammation require it. In two or three days, if the bowels have not acted spontaneously, some mild aperient should be given. In about five or six days the ligature comes off, and shortly afterwards the part will heal, and cease to come down, or come down only in a much less degree than before the operation." (p. 77-84.)

This mode of treating prolapse of the *rectum* is now pretty commonly employed; and from my own experience, I may add that COPELAND has very faithfully and truly described its simplicity, its almost entire freedom from pain, and its great advantages. I have never had occasion to perform HEY's operation, or its modification by DUPUYTREN; and I believe that in almost all cases COPELAND's method will be found amply sufficient, and infinitely less painful.—J. F. S.

M'CORMAC says (*a*), that "reflecting on the procedure in question, (DUPUYTREN's operation,) it occurred to him that the same result might in a measure, at least, whilst the child went to stool, be secured by careful manual traction. * * * Accordingly when the child went to stool, the skin, anterior to the *anus*, was drawn to one side by means of the fingers extended around. The little girl submitted to this with some reluctance, and complained that she could not evacuate her bowels. She was encouraged, however; a stool was obtained; from that day and date, now a month since, the bowel has not once descended. * * * The little girl requires comparatively little attendance, her mother, in fact, is only required to stand by, and in a short time, it is to be hoped, her onerous and anxious ministry will wholly cease." (p. 417.)]

1302. In an old prolapse of the *rectum*, a considerable enlargment, and and at last hardening of the prolapsed part, is often gradually produced by the contact of the air, rubbing, and so on. If in such case the return be not possible by continued supine posture, by keeping up pressure and the use of cold applications, or if doubtful symptoms arise, the protruded part of the *rectum* must be cut off at its base. In doing this considerable bleeding is always to be feared, for which plugging, employed in the way prescribed, (*par.* 939,) is no certain remedy, as it is easily thrown off, or displaced, by violent forcing, and, as I have seen, fatal bleeding ensues. It is preferable, after the removal, to touch the bleeding part with the actual cautery, by which the bleeding is more certainly stanched, and the elastic power of the *rectum* increased. In order to meet the danger of bleeding in cutting off a degenerate prolapse of the *rectum*, SALMON (*b*) has proposed the following proceeding, which he has found by experience to be sufficient. The patient being properly placed, and the buttocks separated from each other by an assistant, he thrusts one or more stout straight needles from above downwards, through the base of the swelling. As the needles penetrate the muscular coat, they prevent its return after the tumour is cut off. He now takes hold with the hook, or with forceps, of a portion of the swelling, draws it gently towards the opposite side, and cuts it off with one stroke of the scissors, as deep as the line between the mucous and muscular coats, which must be spared, as otherwise there will be slight difficulty in going to stool. In the same way all the other portions are to be removed. After the removal, the bleeding is to be stanched by the usual means; cold water is usually sufficient; most commonly it stops of itself. If the vessels are to be tied, it may be done easily, as the wounded surfaces are kept out by the needles. The needles are to be left in for an hour; and the wounded surface should be anointed with oil.

In irreducible prolapse, which causes severe and dangerous symptoms, the application of the actual cautery was early recommended by LEONIDAS, SEVERINUS, TULPIUS, LEVRET, and others.

[The use of the actual cautery to produce sloughing of an obstinate prolapsed *rectum* was recommended by ANSIAUX (*c*) in consequence of the cure he had noticed to result after a natural slough of the protruded gut; he operated on three women at the different ages of sixty-two, thirty-five, and sixty years, with success. DUPUYTREN objects (*d*) to the cautery, that "independent of the severe pain it causes, it may produce violent and more or less serious inflammation of the intestine and of the neck of the bladder." (p. 161.)]

(*a*) Dublin Journal of Medical Science, vol. xxiii. 1843.

(*b*) Practical Observations on Prolapsus of the Rectum. London, 1831. 8vo.

(*c*) Above cited.

(*d*) Above cited.

1303. The prolapse of an ensheathed upper intestine, of the lower end of the *colon*, of the *cæcum*, even of the *ileum*, is usually distinguished by its having some inches of length, and by its condition. The only aid consists in the return of the prolapsed part into the *rectum*, and in keeping it up. If the finger be insufficient for its return, an elastic tube, and even the dashing of cold water (BOYER) must be used. A very large portion of ensheathed intestine of considerable length has been observed to separate and to be thrown off.

[In connexion with prolapse of the *rectum* it may be well to notice here two conditions mentioned by BUSHE.

1. *Relaxation of the Anus*, which "depends upon a want of contraction in the sphincters the causes of which are:—disease or injury of the brain or spinal cord, exhaustion attending weak health, sedentary habits, protracted diseases or old age, excessive or repeated dilatation of the *anus*, produced by straining in chronic dysentery, the introduction or extraction of foreign bodies, and the growth of tumours from within the intestine, and finally operations performed for fistula, fissure, &c. The consequences of this affection are proportionate to the want of power in the sphincters; thus, when they are completely paralysed from disease, or injury of the brain or spinal cord, the *fæces* are discharged involuntarily; whereas in that diminution of tonicity in their fibres, which depends upon constitutional exhaustion, the discharge of *mucus*, attended perhaps with slight excoriation of the verge of the *anus*, is the most troublesome symptom. It not unfrequently happens that the mucous membrane is protruded, and should the dilatation be considerable and prolonged, especially in elderly persons, the surrounding skin will lose its elasticity, which it is not very apt to recover, even though the sphincters be restored to their primitive condition." The treatment will depend upon the cause; if the brain or spinal cord be at fault, these must be looked to; if there be hæmorrhoidal or other tumours, they must be removed; and if the general health be impaired, it must be improved. "The best local remedy," says BUSHE, "is the injection of half a pint of cold water, three times a day." Stimulating vapours and compresses dipped in astringent washes are recommended by some practitioners. (pp. 213, 14.)

2. *Relaxation of the rectum with invagination of the mucous membrane* "is disposed to by repeated distension of the bowel with *fæces* or injections. When the *rectum* is empty or relaxed, and the individual strains violently to effect a motion, the mucous membrane may be forced into the inferior part of this intestine, and thus partially obstruct it, so that the fæcal matter lodged above can be but imperfectly discharged. If the finger be introduced, the nature of the case will be easily discovered. The bowels are confined; the calls to defecate are frequent, urgent, and generally ineffectual, nothing being voided but mucous or puriform matter, often streaked with blood; finally, the pain is always considerable, but occasionally violent. A well-regulated diet, gentle aperients, emollient followed by astringent injections, and the use of the inflated gut or bougie will generally suffice for its removal. If, however, the nature of the case be not detected, one of two things must follow: either a complete *prolapsus* will ensue, or what is worse, the displaced membrane will, from irritation and inflammation, become thickened and indurated, and the opening through it contracted." (p. 215, 16.)

The case quoted by SALMON, and which was under the care of SOMME (*a*), appears to me to have originated in this relaxation, though the young woman is stated to have been "long affected with a contraction of the *rectum*, three or four inches above the *anus;* and the bridle forming the ring, hard, callous, and so contracted, that it only allowed liquid matters to pass, whence arose obstinate constipations and colic;" for SOMME continues:—"I tried dilatation with bougies, which had momentary success." Now if a stricture had formed, the bougie would not have passed, but if, as seems probable, the obstruction was caused by the descent and ensheathing of the mucous membrane, the introduction of the bougie would carry it up and unfold it, and thus the obstruction be got rid of for the time. That this was really the case seems to be proved by her becoming attacked some time after with severe constipation, which lasted three weeks, accompanied with vomiting, swelling, and pain in the belly, violent colic and fever. She was treated for *enteritis*, the constipation overcome with clysters, which were followed by copious sanguineous *diarrhœa.* Subsequently the evacuations became free, the fever ceased, and some days after "a piece of membrane protruded

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(*a*) Etudes sur l'Inflammation. Paris, 1830. 8vo.

by the *rectum*, which being slightly pulled, brought away a portion of intestine about a foot long. This was not false membrane, but wholly intestine; internally the villous coat was black, externally the surface was smooth, and there was a groove upon it indicating the attachment of the mesentery."

Salmon makes a very good observation in reference to the incautious use of clysters, which have been noticed as one cause of relaxed *rectum*. "Many persons," says he, "are daily in the habit of throwing immense quantities of fluid into the *rectum*, by which it is forcibly distended and irritated; thus, instead of the enema affording relief, it is productive of serious irritation; but a far greater evil resulting from this practice is, that the *rectum*, from the immoderate distension thus induced, is rendered unsusceptible of the natural stimulus arising from the *ordinary* accumulation of fæculent matter;" and in support of this statement he relates a case of supposed stricture of the *rectum*, in which he passed number eleven bougie without difficulty, to the great surprise of the patient, who for some time had lost nearly all power of relieving the bowels which never acted without the assistance of medecine or an enema, "he having been in the habit of pumping a couple of quarts of thin gruel into the intestine once, and occasionally twice every day." (pp. 23, 24.)]

D.—OF CHANGED DIRECTION OF THE WOMB.

Medical Observations and Enquiries, vol. iv. London, 1771.

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Meissner, F. L., Die Schieflagen und die Zurückbeugung der Gebärmutter, nebst einer Zugabe über die neuerlich bekannt gewordene Umbeugung derselben. Leipzig, 1822.

Mende, L., Von der Zurückbeugung der Gebärmutter in geschwängerten und ungeschwängarten Zustande; in his Beobachtungen und Bemerkungen aus der Geburtshülfe und gerichtlichen Medicin, vol. ii. p. 150.

Blundell, James, M.D., above cited.

Rigby, Edward, M.D., on Retroversion of the Unimpregnated Uterus; in his Reports on Diseases of Females; in Medical Times, vol. xiii. 1845.

1304. The womb is subject to various changes of direction, inasmuch as its axis may deviate backwards, forwards, or to either side from that of the *pelvis*. The former two states only will be here specially considered.

1305. If the long axis of the womb vary so much from that of the *pelvis*, that cutting it at a more or less acute angle, its base be directed towards the rump-bone and the mouth of the womb towards the share-bone, this displacement is called *Retroversion of the Womb* (*Retroversio Uteri*, Lat.; *Rückwärtsbeugung der Gebärmutter*, Germ.; *Rétroversion de la Matrice*, Fr.); but if its base drop towards the share-bone, and the mouth of the womb be inclined towards the rump-bone, it is called *Antroversion (Antroversio Uteri*, Lat.; *Vorwärtsbeugung*, Germ.; *Antroversion*, Fr.) The former position is more frequent than the latter, and both may occur to a greater or less extent.

1306. *Retroversion of the Womb* occurs more frequently during pregnancy, especially in the third and fourth months, than in women not pregnant; it is, however in these often enough, and (according to Schweighaeuser and Schmitt (*a*)) even more frequent than during pregnancy; and my own observations on this point concur with that opinion.

[Rigby is also of this opinion, and observes:—"I am sure I have the confirming testimony of Dr. Simpson and Mr. P. Smith when I state it to be one of the most common displacements to which the *uterus* is liable in the unimpregnated state, and that this form of it occurs *far more* frequently than the ordinary retroversion during pregnancy," (p. 124.) There is, however, a difference between the retroversion which occurs whilst the woman is pregnant, and that when she is not so; for Rigby observes:—"The case now alluded to is where the *fundus* is bent downwards and backwards; so that it can be felt close behind the *os* and *cervix uteri*, which, instead of being forcibly dragged upwards and forwards behind the *symphysis pubes*, is little, if at all, removed from its natural situation. This state of retroflexion (a term which Rigby prefers to retroversion, j. f. s.) is chiefly met with in the unimpregnated *uterus*, although it sometimes occurs during pregnancy." (p. 124.)

"In different women," observes Blundell, "the womb varies very much in its virgin size; for in some it is three times as large as in others. Now if it so happen that the womb is very small, and that retroversion has taken place without impregnation, the pressure which it occasions may be so inconsiderable, that the nature of the case may remain unsuspected; but when the womb, though unimpregnated, chances to be of large size, especially if the *pelvis* is small, or contracted, considerable pressure may be produced, and we are first led to investigate its nature, in consequence of the irritation and obstruction of the *rectum* and the bladder, when the accident is soon recognised by the characteristics before given." (p. 19.)]

1307. It is probable that retroversion of the womb in pregnant and not pregnant women is not produced at once; but by degrees, under favourable circumstances, a complete retroversion is gradually formed from a simple reclining of the womb. The following may be noticed especially as predisposing causes, slight inclination and great capacity of the *pelvis*, low position of the intestines, perhaps also Douglas's folds, peculiar deviation of the original formation (*b*), relaxation of the broad and round ligaments of the womb. The occasional causes are, pregnancy, overfilling of the urinary bladder, stools unfrequent or accompanied with great effort, constant lying on the back, increased weight, swelling, or other degeneration of the hinder wall of the womb, violent straining, and so on.

Retroversion cannot occur in a perfectly healthy state of the womb; were it even possible, it could not readily produce such severe symptoms. The chronic inflammatory state of the womb, which most commonly gives rise to retroversion, causes pain and dragging in the back and loins, difficulty in walking, difficulty in voiding the urine and in going to stool. On examination, a lower position of the womb, swelling and

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(*a*) Richter's chirurgische Bibliothek, vol. v., p. 132, vol. ix. p. 310.—Stark's Archiv. für die Geburtshülfe, vol. iv. p. 637.—Osiander; in Salzburg. Med.-chirurg. Zeitung, 1808, vol. iv. p. 170.—Brünninghausen; in von Siebold's Journal für Geburtshülfe, Frauenzimmer- und Kinderkrankheiten, vol. iii. p. 59.—Schweighaeuser and Schmitt, above cited.

(*b*) Schreger; in Horn's Archiv. 1817, March and April, p. 311.

sensibility of its vaginal portion are observed; most commonly also is there a flow of *mucus* from the generative organs. The two last symptoms distinguish it from pregnancy (*a*).

1308. The symptoms which indicate retroversion of the womb depend on the obstructed or completely suppressed discharge of the urine and stools, and on the diseased changes which arise in the displaced womb. These symptoms in general occur suddenly in retroversion during pregnancy, which greatly prevents and often entirely suppresses the voidance of the stools and urine; severe and extremely painful dragging come on with a feeling of pain, weight, and fulness of the belly, also distension and painfulness, disposition to vomit and actual vomiting, fever, extreme restlessness, abortion, and even death from tearing of the bladder, and inflammation and gangrene of the intestines of the belly (*b*).

The seeming retroversion of the womb, mentioned by MENDE, must be noticed, in which case at the later periods of pregnancy, its hinder wall expands like a sac, producing similar symptoms to the true prolapse, usually terminates in abortion, and is distinguished by the mouth and neck of the womb not at all deviating from their natural position (*c*).

[(1) BLUNDELL observes, that "the patient often tells her adviser that she has been placed in some situation of restraint, and that afterwards, on retiring, and trying to evacuate the contents of the bladder, not a drop of the secretion would pass away, and this has occurred perhaps for hours before you see her, the accumulation having continued ever since; so that there is a great deal of pain of the *abdomen* and heat, with forcing and fluctuation, which may be felt as distinctly as in a case of *ascites*. I wish it to be understood, however, and very important it is that this should be known, that in the retroversion of pregnancy, you have not always, nor I think generally, these *complete retentions* of urine; for often, where the *uterus* is retroverted, the retention is partial. In a case recorded by VAN DOEVEREN, although the woman passed her urine every day, still she died from a ruptured bladder. * * * Day after day the fluid is sparingly emitted, but never in such quantity as to empty the bladder completely, till by-and-by, perhaps, the secretion begins to steal away involuntarily, or she may have strong efforts to pass the urine, even against her will, and with every effort a small gush only may be produced, or there may be a continual dripping, and yet, notwithstanding all this, an accumulation of water may go on very gradually, so that several pints, nay, several quarts, may be gradually accumulated, as in the following example:—'A woman labouring under symptoms like *ascites*, a practitioner proposed, I think, the operation of tapping. There was, however, some obscurity about the case—a great deal of pain more especially—and, an obstetrician being called in, in consequence, a catheter was introduced, and water drawn to the amount of seven quarts, which had been accumulating in the bladder for two or three weeks, in consequence of a retroversion of the *uterus*.'" (pp. 7, 8.)

(2) LACROIX remarks (*d*) that, whether by sympathy or direct irritation, is not so evident; but it is often seen, nevertheless, that when the retroversion is sudden, either in the virgin, or pregnant female, hiccup, flatulence, vomiting, fainting, &c., commonly show themselves; and, even when the displacement is more gradually produced, analagous symptoms of less intensity are present.]

1309. On examination with the finger in the *vagina*, the mouth of the womb is found behind or above the share-bones; often scarcely, some-

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(*a*) ROBERTSON, Cases and Observations on simple chronic inflammation of the Uterus, in which state its organ may become retroverted; in Edinburgh Med. and Surg. Journ, 1822, Oct., p. 520.

(*b*) LINNÉ and HUNTER; in Med. Observ. and Enquiries, vol. iv.—SAXTORPH, above cited.—WILMER, Cases and Remarks in Surgery. London, 1779;—HENSCHEL; in LODER'S Journal, vol. iii. p. 536.—NAUMBERG; in STARK'S Archiv. vol. vi. p. 381.—VAN DOEVEREN, Specimen observationum academicarum ad monstrorum historiam, anatomen pathologicum et artem obstetriciam spectantium. Groning, 1765.—REID'S Fall einer Rückwärtsbeugung der Gebärmutter in fünften Monate der Schwangerschaft; in FRORIEP'S Notizen, September, 1838, p. 304.

(*c*) On Retroversion of the Womb after birth, with tearing of the hind wall of the *vagina* and prolapse of the *fundus uteri*.—See DUBOIS; in Presse Médicale, May, 1837. No. 20.—SCHNACHENBERG; in CASPER'S Wochenschrift, 1838. No. 34-35.

(*d*) Annales de la Chirurgie, vol. xiii. p. 457, 1845, April.

times not at all reachable, and on the hind wall of the *vagina* is the *fundus* of the womb, descending against the rump-bone like a lump, which on examination is felt through the *rectum.*

["In examining a case of retroflexion of the unimpregnated womb during life, the finger," says Rigby, "can frequently reach a firm globular mass like a walnut, situated behind the *cervix uteri*, and evidently posterior to the *vagina.* At the first touch, or to one unacquainted with this condition of the womb, it seems like a lump of scybalous matter in the *rectum;* for in many, perhaps most instances, the finger cannot reach sufficiently high up to distinguish the continuity of this mass with the *cervix*, the point of flexion being usually in the body of the *uterus*, close above its junction with the *cervix.* This, however, varies considerably, both in different cases and in the same individual, and at different times. In some cases the curve is much higher, so that the whole of the *uterus* seems to be in the natural position, except a sharp bend or double at its uppermost portion. In others, the point of flexion is so low down that it can be easily reached, and the *fundus* is felt much lower than the *os uteri.*

"On examination *per rectum* we feel the same hard lump through the anterior wall of the intestine; and by being able to reach higher up in this direction than with the finger *per vaginam*, we can frequently verify or correct our first impression. But it is by the uterine sound, invented by Professor Simpson, that we obtain such peculiarly valuable and interesting results in this form of uterine displacement. On passing the instrument in the usual direction upwards and forwards, it becomes almost immediately arrested; but on turning its point backwards, exactly in the contrary direction, it will pass readily along the *cervix*, and then glide downwards and backwards, until the measure mark of two and a-half inches having reached the *os uteri*, shows us that it has entered to the natural extent of the uterine cavity; the point is now evidently in the centre of the tumour between the *rectum* and *vagina*, as may be felt through either of these passages, thus proving it to be the *fundus uteri* in this unnatural position. By carefully turning the instrument round, and carrying its point upwards and forwards in the natural direction of the *uterus*, we shall also carry up the *fundus* upon it and restore the *uterus* to its proper position. On examination either by the *vagina* or *rectum*, we now find the tumour has entirely disappeared; and as far as the finger can reach through the latter passage, the *uterus* will be felt in a direction upwards and forwards, and held in that position by the sound within it. In some instances the *uterus*, when once replaced, maintains its natural position either permanently, or at least for some little time afterwards; but in many, especially those of long standing, and where the *fundus* has been forced very low down, the handle of the sound requires to be held firmly so as to keep the *uterus in situ;* and the moment we loose our hold of it, (the handle,) it will turn round, rising at the time upwards and forwards towards the *symphysis pubis*, showing that its point has turned downwards and backwards. In other words, the *uterus* has returned to its former state of displacement, carrying the sound along with it; we shall now again feel the tumour in the recto-vaginal sac, containing the point of the sound within it.

"On examination *per vaginam* we shall find that pressure on the retroflected *fundus* seldom produces pain until we try to push it up against the ovary; the sound will pass into the *fundus* without causing much uneasiness, but if we carry the finger to the upper parts of the *vagina* into the vicinity of the ovary we shall excite severe pain. The same will be observed in examination *per rectum:* the instant we press up the *uterus* the patient complains greatly, but *per se* the *uterus* is not painful, and we can ascertain that the intensely painful spot is distinctly above the tumour formed by the retroflected *uterus.* These and other symptoms resulting from ovarian irritation or inflammation cannot, therefore, be looked upon as a necessary accompaniment to retroflection, although there is no doubt that they are frequently present; but the two affections are sufficiently often associated to justify a careful examination of the position of the *uterus* in every case of chronic *oophoritis.*

"In some cases the canal of the *cervix* is so closed at the point of flexion as to resist every attempt to introduce the sound, and the dilator must be carefully premised until a sufficient passage has been obtained. I have reason, however, to think that when the canal is so closed as to require the dilator, it is rather owing to a congenital formation than to the effects of the bent state of the *uterus*, which last is, however, sufficient not only to obstruct the free discharge of the *catamenia*, but also to prevent conception." (p. 125.)]

1310. The symptoms do not occur so quickly in retroversion of the womb in women who are not pregnant, and vary according to the degree of retroversion and the condition of the womb. Only with slight reclination and little sensibility of the womb do no symptoms occur; if there be much sensibility, dull pain occurs in the bottom of the *pelvis*, dragging, painfulness on examination, sometimes difficulty in the discharge of the urine and stools, and gradual organic changes in the womb. In a greater degree of reclination, swelling up of the whole womb is observed, but especially of its hind part with increased sensibility to the touch; increased weight and difficulty in moving about. The sensation of constant pressure in the region of the *rectum*, with difficulty in voiding the stools and urine. In completely retroverted womb dragging pains, swelling, weight, immobility of the womb, often inflammation and great painfulness on examination, suspended or irregular menstruation, and difficult voidance of the urine and stools occur. If the retroversion take place after delivery, it may cause continued and dangerous flooding (*a*). It is self-apparent that these symptoms must be variously modified by the simultaneous changes in the structure of the womb, and that examination must demonstrate a different relative position of the mouth and base of the womb, according to the different degree of displacement. If the womb be fixed in its unnatural position by adhesions, the retroversion may even be fatal from the inflammation of the intestines lying in the *pelvis* (*b*).

["The presence of this displacement is not necessarily indicated," says RIGBY, "by any peculiar symptoms; indeed, in some instances, I have found it existing without a single circumstance to make the patient suppose that she was otherwise than in a state of the most perfect health, even as regards the catamenial periods. Generally speaking, however, there is a dull pain and sense of pressure about the *sacrum*, verging to one side or the other, according to the direction which the *fundus* has taken. In some instances she has pain and numbness down the thigh of that side, with difficulty or inability to move or stand upon it, and probably arising from the *fundus* pressing on some of the sacral nerves, since the pain is instantly removed by the replacement of the *uterus*, and the numbness or lameness ceases in an equally striking manner. At times this pressure increases to a severe bearing down, which after a while again subsides, and which is probably connected with the passage of *fæces* along the neigbouring intestines, and more or less depressing the *fundus*.

"In a considerable number of cases there are distinct marks of ovarian inflammation on the side to which the *uterus* inclines; or at any rate I may say that, in a large majority of cases, as it is the left side to which the *uterus* inclines, so is it also the left ovary which is most frequently painful. These are, in fact, the ordinary signs of *oophoritis*." (p. 125.)]

1311. As to *prognosis*, the bad symptoms have been already mentioned which especially occur in retroversion. It must be especially observed in not pregnant women, whether the organic changes of the womb be preceded by retroversion, or whether they be consequent on it; in the former case the restoration of the proper position of the womb is the most perfect cure, but in the latter not.

["With respect to the prognosis of retroversion," BLUNDELL remarks, "that where the womb is replaced, the patient, in general, does well enough, provided you proceed on the principles prescribed; yet it is not impossible that miscarriage may take place after reduction; for in two or three instances I have known this take place. Inflammation of the bladder of the acuter kind may occur, and you may have a chronic disease of this organ. Where there is a good deal of inflammation, your patient may die of exhaustion. You may find that some officious hand has thrust a catheter through the back of the bladder into the *peritoneum*, and that the escape of the urine into the *peritoneal* sac has destroyed the patient. The bladder in some rare cases may be burst

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(*a*) BRÜNNINGHAUSEN, above cited.

(*b*) SCHWEIGHAEUSER, above cited, p. 253.—SCHMITT, above cited, p. 16.

open, of which I possess a very beautiful preparation. The *uterus* is as large as a child's head; above the retroverted *uterus* is the bladder which has been ruptured. It is remarkable that in this rupture of the bladder, which has arisen from its over distension, it is not the front, that surface of it, I mean, which has no *peritoneal* covering, but it is the posterior surface, invested by the *peritoneum*, the back part of the body, which is the region of the rent. Now it was this which first led me to propose, that where a rupture of the bladder takes place in any case, but especially in a retroversion of the *uterus*, we should not give the patient up for lost; for if there is reason to believe that the bladder is burst into the *peritoneal* sac, we might make an opening into the *peritoneum*,—say above the *symphysis pubis*,—by which we might discharge the urine, and then injecting distilled water, of the temperature of 98°, we might wash the *viscera*, so perhaps as to prevent a general *peritonitis;* this done, we might draw the bladder up to the opening, and close the rent by ligature. This operation I have performed on several rabbits; in one or two experiments I brought the bladder out, tied it up, and took away about one quarter of it, viz., the whole of the *fundus*, and the animal did perfectly well. This operation I have never had occasion to try on the human subject; but in a case otherwise desperate, I should be inclined to recommend it. I may here remark, that since I have suggested this method of closing the bladder by ligature, Mr. TRAVERS (*a*) has performed the operation on the stomach; there was a slight wound in the organ; he boldly tied up the aperture; the thread came away, and the case did perfectly well." (pp. 19, 20.) It must not be supposed that TRAVERS made the ligature on the wounded stomach from BLUNDELL's suggestion; ASTLEY COOPER had long before tied up the hole in a gut, wounded during the operation for strangulated rupture, and the case did well. TRAVERS himself had also, some years before BLUNDELL's proposal, considered the matter, related experiments on the subject, and laid down rules for the application of the ligature. But BENJAMIN BELL had mentioned this question even long before TRAVERS (*b*).]

1312. The *treatment* of retroversion of the womb consists in emptying the bladder and *rectum*, and on the restoration of the natural position of the womb.

1313 Emptying the bladder is effected by the introduction of the catheter, which is rendered easy if with two fingers of the one hand, that part of the *vagina*, opposite the pubic *symphysis*, be smoothed and pushed upwards, or if its more elevated position forbid this, if it be merely pressed backwards. This manipulation is not without advantages even if the entrance of the *urethra* be so much drawn inwards, that it cannot be seen, or if any other obstacle to the use of the catheter exist (*c*). When drawing off the urine is completely impossible, puncturing the bladder above the *pubes* has been proposed (*d*).

Emptying the *rectum* is to be attempted with clysters (which can often only be done with difficulty) of decoction of barley and grass roots, with the addition of salt. Experience shows that in many cases, after this previous treatment, the retroverted womb of itself recovers its position (*e*). Hence by many, the replacement is considered unnecessary, and the distensions of the bladder and *rectum* held as the special cause of the retroversion. If inflammatory symptoms be also present, they must be attacked with suitable treatment.

1314. The modes of proceeding for the replacement of the retroverted womb are very various. The patient being placed on her knees and elbows, the base of the womb is to be pressed forwards and upwards towards the navel, with two fingers introduced into the *rectum* (*f*); which manœuvre may perhaps be assisted by two fingers passed into the *vagina*, and

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(*a*) This case is cited in the first volume of this work, p. 476.

(*b*) Ibid., p. 468.

(*c*) NÄEGELE and SCHMITT, above cited.

(*d*) CHESTON; in Medical Communications, vol. ii. p. 6.

(*e*) VERMANDOIS; in Journal de Médecine, vol. lxxxviii.—CROFT; in London Medical Journal, vol. xi.—DENMAN, T., Introduction to the Practice of Midwifery. London, 1801.

(*f*) HUNTER, W., SAXTORPH, RICHTER, and others.

attempting to draw down the mouth of the womb. Some recommend the replacement to be effected by the fingers (*a*) introduced into the *vagina*, and in difficult cases, even the whole hand (1). The difficulties which have occurred in certain cases have led to the use of elevating instruments (*b*), to the proposal of puncturing the womb (*c*) (2), of cutting through the pubic *symphysis* (*d*), and of opening the belly (*e*).

(1) Bellanger (*f*) advises, when, on account of the elevated and forward direction of the neck of the womb, it is not possible to employ the fingers through the *vagina*, to introduce a flattened catheter into the bladder, and therewith to bring down the neck of the womb, whilst with the fingers in the *rectum*, its base is lifted upwards. This object was effected in a case where attempts at replacement had been vainly made in different ways. See also Lallemand (*g*).

(2) Puncturing the base of the womb through the hind wall of the *vagina* has been successfully performed by Jourel of Rouen. Baynham (*h*) has performed it successfully, by a curved trocar passed through the *rectum* into the most projecting part of the swelling.

Halpin (*i*) effects the replacement, by inflating a bladder introduced into the *vagina* in the following manner. "I attached," says he, "a small recent bladder to the tube of a stomach-pump, with an air-tight piston, and, having immersed it a few moments in warm water, to bring it to the heat of the body, I introduced it, empty, into the *vagina*, between the *fundus* of the *uterus* and the *rectum*. Retaining it within the *vagina*, by holding my hands firmly across the orifice, it was then slowly and steadily inflated. After a time she complained of a sense of tension or bursting, but no pain. We then ceased throwing air into the bladder, allowing what was in already to remain, keeping up as it did a steady, equal, well-directed pressure on the tumour. After the expiration of five minutes, we threw more air into the bladder, when the patient exclaimed, slowly, "Oh! now you are forcing something up to my stomach." I retained the bladder some time longer in its situation; and then, previous to withdrawing it, permitting the escape of some air, I introduced my finger, and had the satisfaction of finding that the tumour was no longer in the *pelvis*, and that the *os uteri* lay within reach of my finger, pointing downwards and backwards. * * * The retroversion having been rectified, I would introduce, as a pessary, a gum elastic bag, constructed on this principle, and inflate it to a proper state of distension." (p. 76.)

1315. If the fitness of these different modes of treatment be compared, the preference must, from the result of experience, be given over all other to the replacement through the *vagina*, as a far greater number of successful cases to have been ascribed it than to that by the *rectum*, which has been often unsuccessfully attempted, even with the whole hand, and with the employment of great force (*k*). As to the more heroic proposals for realizing the replacement, none indeed, except puncture of the bladder, is permissible, as in the cases where, after emptying the *rectum* and bladder, the symptoms are not diminished, and the proposed manipulation is insufficient, such fixing of the womb in its unnatural position may occur, that the replacement is impossible in any way, as Hunter found on dissection of a person who died from this disease (*l*).

1316. In reference to retroversion of the womb in women not pregnant, those rules apply, which have been given for the removal of the symptoms caused by the retention of urine and stools. As to the replacement,

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(*a*) Lohmier and Naëgele, above cited.

(*b*) Salzb. med.-chirurg. Zeitung, 1791, vol. i. No. 1. —Osiander, above cited.—Richter, G. M., Synopseis praxeos medico-obstetriciæ. Mosq., 1810, p. 69.—Schmitt, above cited.

(*c*) Hunter, Wm., above cited.—Bellanger, above cited, p. 235.

(*d*) Richter; in Chirurg. Bibliothek, vol. vii. p. 729.

(*e*) Callisen, Systema chirurg. hod., vol. ii. p. 670.—Fiedler, in Rust's Magazin, vol. ii. p. 243.

(*f*) Mémoire sur la Rétroversion de l'Uterus; in Révue Médicale, 1824, Feb., p. 229.

(*g*) Ibid., May, 1824, p. 191.

(*h*) Edinburgh Med. and Surg. Journal, vol. xxxiii. p. 256.

(*i*) Dublin Journal, vol. xvii. 1840. No. 49.

(*k*) Vermandois, above cited.

(*l*) Einige medicinische und chirurgische Beobachtungen u. Heilmethoden. Aus d. Engl. gesammelt und mit vielen Zusätzen herausgegeben von K. G. Kuhm. Leipz., 1784, vol. i.

Schweighaeuser considers it unnecessary, in which opinion Schmitt also concurs, as by emptying the bladder with the catheter, and the intestinal canal with opening clysters, and the previous use of neutral salts, with carefully observed position on the side, the rump being raised, and the upper part of the body bent down, nearly always the effect is produced, and the womb gradually resumes its natural position, whilst also the swelling gradually subsides. This may be assisted, if with two fingers introduced daily into the *vagina*, the base of the womb be raised gradually but carefully. If the symptoms be inflammatory, merely mild remedies, emulsions of linseed or almond oil, fresh castor oil, luke-warm bathing, steaming, by means of a sponge laid on the generative organs, relaxing poultices upon the belly, and even general and local blood-letting, and copiously rubbing in mercurial ointment on the insides of the thighs. When the most pressing symptoms have been removed or lessened, then the replacement is to be especially attended to. Only when retroversion of the womb exists without any appearance of acute inflammation, may the replacement be at once attempted, but it must not be too long continued. As to the manipulation of the replacement, all that has been said heretofore applies.

1317. When the womb is returned to its place, it has rarely a disposition to be displaced anew, and the continued position on the side, is sufficient to prevent it. And besides as the womb enlarges during pregnancy, its retroversion is no longer possible. If there be a special disposition to retroversion, a round or oval pessary, with a pretty large aperture, or a sufficiently large piece of sponge introduced into the *vagina* and fastened with a T bandage, will prevent it. This applies also after the replacement of the unimpregnated womb. The patient should very carefully avoid keep ing on her back (*a*).

["In some few instances," says Rigby, "the displacement has been permanently removed by once rectifying the position of the *uterus* with the uterine sound; but this favourable result is rather the exception than the rule, and some mechanical means is therefore required to retain the *uterus in situ*. The supporter used by Professor Simpson is excellently adapted to this object, and has answered well It consists of a pin the length of the uterine cavity, (two and a-half inches,) fixed in a disc or button on which the *os uteri* can rest, connected with, and kept in proper position by a little frame resting on the *mons Veneris*, which is fixed and properly adjusted by tapes. Another and equally ingenious mode of supporting the *uterus* he has obtained by means of a species of pessary, to which he has fixed the pin by a spring hinge, like that of a knife-blade. I have never tried this last, but to the other I can bear most favourable testimony, having applied it in a considerable number of cases with which I propose to illustrate this subject. I have lately altered the form of the pin which is passed into the *uterus*, making it flat, instead of round, and broader, so as to adapt it more exactly to the shape of the cavity. The pressure which it exerts on the internal surface of the *uterus* is thus more equable, and over a larger space, and consequently does not produce so much irritation, which, especially at the catamenial periods, is occasionally troublesome, producing also a profuse discharge, and for a longer period than usual. To obviate the chemical action which takes place in an instrument made of German silver, I have had this portion of it made of ivory, at the suggestion of my friend Professor Retzius, of Stockholm, to whom I shewed it, and in two cases it has been worn with much more comfort than with the ordinary pin; the objection, however, to the chemical action on the uterine secretion upon the German silver Professor Simpson had already remedied by electrotyping it with gold.

"The length of time during which these instruments require to be worn varies a good deal, and I have reason to believe that in cases where the displacement has returned, it has been owing to my having removed the support too soon. I believe that a month

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(*a*) Hunter, William; in Medical Observations and Enquiries, vol. iv.

is the minimum period, and that in most instances our chances of success will be much greater if the period be extended to two months, or even longer. (pp. 125, 26.)]

1318. The *Antroversion of the Womb* is more rare than its retroversion, and occurs in both the impregnated and unimpregnated state (1). In the former case it is consequent on violent exertion, on vomiting, on a false step, and so on, with violent pain in the region of the stomach and belly, febrile symptoms, and frequent urgency to void the urine. The region of the stomach is somewhat tender on pressure, the whole belly, full, puffed up, especially the hypogastric region. The stress upon the *pubes* is very troublesome; the forcing of the urine very painful; in which, however, but little is discharged, and only in drops; therewith usually is there great urgency to going to stool, with thin and small motions. A swelling as big as the fist, seems to lie in the depth, behind the pubic *symphysis*; it can, however, only slightly be felt. The drag upon the bladder becomes exceedingly severe, without a drop of urine being discharged, a violent attack of fever takes place, disposition to vomiting, and the hypogastric region will not bear the least touch; the distended urinary bladder may so cover the swelling of the womb that it can no longer be felt. On examining the *vagina*, its entrance is narrow; the finger more deeply introduced, strikes immediately behind the pubic *symphysis*, upon a semilobular swelling, which drops into the little *pelvis*, feels smooth, elastic, and soft, and somewhat tender. The vaginal part is either not at all felt, or only with difficulty, in the more free hinder space of the *pelvis* above, pressed against the *rectum* in the hollow of the rump-bone, and otherwise forming a continuation with the swelling, so that the finger cannot be carried round between the two. Neither the vaginal portion nor the swelling are movable by pressure.

The symptoms of antroversion of the impregnated womb differ according to their degree, the period of its origin, and the sensibility of the patient. In the above-described way has HACHMANN (*a*) noted it in antroversion, occurring suddenly in the third month of pregnancy, from a false step. BAUDELOCQUE (*b*) mentions a case of antroversion in the second month of pregnancy after an emetic. NOLDE (*c*).

[(1) BLUNDELL seems to think antroversion of the womb scarcely to be a diseased condition. "It is said," he observes, "that sometimes a change of position may take place, in which the *fundus* comes forward, and the mouth recedes, and which altered position writers have denominated *antroversion* of the *uterus*; but the truth is, that the womb is almost anteverted, frequently the *fundus* is pushed down below the *symphysis pubis*. Repeatedly, in making examinations, have I perceived it in this position, between my fingers, so that, in my opinion, these anteversions of the *uterus* can scarcely be looked upon as extraordinary and morbid. I might say, with truth, that they are perfectly healthy." (p. 21.)

JOHN BURNS (*d*) says:—"Of this accident I have never seen an instance during gestation, and from the nature of the case, it must be very rare; but I have met with it, from enlargement of the *fundus uteri*, in the unimpregnated state." (p. 260.) BOIVIN and DUGÈS say they have had frequent occasion of observing, after parturition, a decided inclination of the *fundus uteri* forward, the condition of the womb being intermediate between obliquity and retroversion.

This form of displaced womb is mentioned also by GRAY, of New York (*e*), as "a dislocation of the womb downward, and slightly backward, the *os tincæ* tending towards the *coccyx*. The ano-perinæal region of VELPEAU, or the *perinæum posticum* of the older anatomists, from relaxation of the *levator* and *sphincter ani*, becomes enlarged, and the triangular space between the point of the *coccyx* and the tuberosities of the ischian bones, forms, in consequence, a broad deep *cul-de-sac*, into which the *uterus* sinks in the line of its own axis, and rests against the *anus* and *rectum*. This posterior dislocation of

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(*a*) Einige Fälle von krankhafter Lageveränderung der Gebärmutter; in Hamb. Magazin der aüsländ. Literatur. Nov., Dec., 1834, p. 352.

(*b*) L'Art des Accouchemens, p. 255.

(*c*) Beiträge, p. 220.

(*d*) Principles of Midwifery.

(*e*) On External Pressure in Prolapsus Uteri; in London Med. Gaz., vol. i. New Series, 1838-9.

the womb often takes place in pregnancy, particularly during the first four months; but it also takes place under other circumstances, I have no doubt, and that much more frequently than is commonly supposed. * * * The posterior displacement will be readily recognised by examination *per anum.* The finger will have to pass very much more backward than usual to get around the *os tincæ,* which lies hard against the *rectum,* just above the *sphincter ani,* and is very perceptible to the feel of the Surgeon. In passing the finger *per vaginam,* the neck of the womb is first encountered, occupying the situation of the *os uteri.* The *os uteri* is found lying against the *rectum,* its aspect being backward and downward toward the point of the *os coccygis,* will have to be carried back in a curved form to reach it. The space between the *os uteri* and the posterior termination of the *vagina* appears much larger than natural." (pp. 221, 22.)]

1319. In *treating* antroversion of the pregnant womb, if the swelling be firm and immovable, blood-letting, clysters (of an infusion of *belladonna,* according to HACHMANN) should be first employed, and the urine drawn off with the catheter. If the swelling be thereby rendered more movable, or if it be movable from the beginning, and unconnected with any particular symptoms, its replacement is to be attempted. The patient must be placed on her back, with the *pelvis* properly raised, the four fingers of the right hand being passed into the *vagina* are carried up to the deepest lying part of the swelling, and this is to be forced by a gradually increased pressure upwards, and in its slow yielding, somewhat backwards, whilst the left hand fixes the hypogastric region immediately above the pubic *symphysis.* In HACHMANN's case, very considerable, and for the patient, extremely painful force was employed, in order to lift the swelling out of the little *pelvis.* When this was effected, and the mouth of the womb removed from the rump-bone into the axis of the *pelvis,* the hand was withdrawn, and the pain ceased as by enchantment. Continuance on the back for some time is sufficient to prevent the recurrence of the displacement.

[BOIVIN and DUGÈS mention a case in which the *fundus uteri* inclined forward, lower down than the *cervix,* and in which reduction seemed impracticable; yet, nature alone, during the progress of gestation, accomplished the cure.

GODEFREY, of Rennes, relates (*a*) two instances in which the natural position of the womb was restored simply by position. The first case he was unable to see; but directed that the woman should be put on the side of the bed, with her head and hands on the floor, and with the front of the thighs and legs only resting on the bed. In this position, he says, that the intestines, being drawn towards the diaphragm, the *pelvis* is emptied, and the womb, being no longer pressed on, resumes its natural position. After the patient had been in this posture fifteen minutes, all pain ceased. In the second case the woman was thirty-three years of age, had been pregnant between three and a-half and four months of her first child. She was attacked with weight in the *pelvis,* and frequent disposition to make water. Nothing having been done, excepting that she went to bed, and the symptoms continuing next day, an examination was made, and the neck of the womb was felt behind, and towards the curve of the *sacrum,* while the *fundus* was in front, and behind the *os pubis,* the bladder not being very full, the catheter was not passed, but she was placed in the position just mentioned, upon the side of the bed, for twenty minutes. The feeling of weight in the *pelvis* diminished, and the desire to void the urine ceased.]

1320. The antroversion of the womb in its unimpregnated state, occurs either suddenly or slowly. In the former case, it produces violent pain, fever, great difficulty in voiding the urine and stools; in the latter, the difficulty of passing the urine and stools is less. The patient has, when she walks, the sensation as if a hard body fell upon the bladder, causing urgency to void the urine, which body again falls back when the patient lies on her back. Thence the possibility of confounding this condition

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(*a*) Annales d'Obstétrique des Maladies des Femmes et des Enfans, Jan. 1842; and London and Edinburgh Monthly Journal of Medical Science, vol. for 1842, p. 313.

with that of a stone in the bladder (*a*). Oftentimes there arise hæmorrhoidal affections, severe pain in the belly, suppressed or too frequent menstruation, and the whites; conception may be prevented. In examination with the fingers through the *vagina*, the base of the womb is found in front above the share-bones, its mouth situated opposite the rump-bone, and frequently so high that it can scarcely be reached. SIEBOLD (*b*) has found the vaginal part connected with the *rectum*.

1321. The *causes* of antroversion of the womb are much inclined *pelvis*, loose connexion of the womb with the bladder, high position of DOUGLAS's folds, too early getting up after delivery, continual costiveness, organic changes in the base of the womb, and bodily exertion of various kinds.

1322. The restoration of the natural position of the womb is easy. With two fingers introduced into the *vagina*, it is to be attempted to bring down the mouth of the womb, whilst with the other hand above the share-bones, the base of the womb is to be pressed backwards and upwards. The patient must continue a long while upon her back, a bandage should be applied round the belly, close above the *pubes*, and if this be insufficient to keep the womb in its place, it must be supported with a ring pessary. If the vaginal portion be adherent, it may be divided with the knife, and its reunion prevented, by a sponge put in it for a long while (*c*).

[" The pessary in this case," says GRAY, "does no good whatever; it is thrust into the ano-perinæal region, already rendered a sac by relaxation, and by the presence of the dislodged womb, and there, as a really foreign body, excites the same sensation, and keeps up the same irritation and discharges which the womb had done, and generally, as may readily be supposed, the latter are of a very aggravated character; whereas the new instrument of Dr. HULL, (his utero-abdominal supporter,) by pressing the ano-perinæal region upward and inward, directly opposes the descent of the womb, and, at the same time, diminishes the capacity of this region, whilst the hypogastric support of the apparatus prevents the descent of the abdominal *viscera* into the pelvis." (p. 222.)]

E.—OF CURVATURES.

1323. *Curvatures* (*Curvaturæ*, Lat; *Verkrümmungen*, Germ.; *Courbures*, Fr.) are remarkable deviations of certain parts of our body from their natural direction, depending either on an actual bending in the continuity of the bones, or on their bending and distortion in the neighbouring parts, that is, in the joints.

1324. Curvatures are either vices of the primary formation and congenital; or they arise later, and are ordinarily developed without pain. The bones are not divided as in fracture, nor completely displaced at their joints as in dislocation. Only in a great degree of curvature, if the joints be also distorted, deviations gradually occur in the joint-surfaces of the displaced bones; just as in long continuance of the ailment, single bones are differently changed in their form, diminished by absorption, or united by *callus*.

1325. The erect posture of our body, and of the several organs, depends on the *equal antagonizing operation of the muscles*, and on the *firmness of the bones*. The causes of their curvature are therefore *disturbed abolished antagonism of the muscles*, or *changes in the structure of the bones, whereby they lose their proper degree of firmness*.

(*a*) Journal de Médecine, vol. xi. p. 269.

(*b*) Handbuch zur Erkenntniss und Heilung der Frauenzimmerkrankheiten. Second Edit. Frankfurt, 1821, vol. i. p. 737.

(*c*) KYLE, Beobachtungen über Antroversio Uteri in nichtschwangeren Zustande; in VON SIEBOLD's Journal, vol. xvii. pt. i.

1326. The antagonism of muscles is disturbed when either one part possesses an absolute excess of activity above the other, or when one part is so weakened, that it opposes no obstacle to the natural activity of the other. This may be effected by palsy, wounds, weakness of the muscles, continued rest of certain muscles, tonic spasm, ordinary exertion of certain parts, especially in particular positions, by which they are wearied, especially in children still under development, by diseased changes in the muscles, as from gout, rheumatism, inflammation, ulceration, ossification, and so on. The activity of the flexor muscles naturally, especially in the *fœtus*, exceeds that of the extensors; hence also the greater number of congenital and original curvatures arise in the course of the flexors.

1327. The muscles which produce the curvature, suffer always a more or less considerable degree of contraction and shortening, so that they are capable only of little extension, or of none at all. In long continuance of this condition, various changes occur in the tissue of the muscles, they lose their fulness, become thinner, even cord-like, and at last are converted into a fibro-cellular, or fatty mass (1). Whatever be the causes which have produced the contraction of the muscles, these changes are always the same, and their common origin lies in the *continual rest*, in which such muscles are found. Muscles, and, through them, their tendons and *aponeuroses*, must be kept in their constant and proper motion and activity if their vitality and organization is to remain natural, and a harmonious relation to exist between the voluntary influence which depends on the brain and the irritability which originates in the spinal marrow. If the activity of a muscle be damaged by one of the above-mentioned causes, and the muscle be kept in constant rest, it gradually diminishes, and at last all voluntary influence over it is lost, and its irritability and tone increase correspondently; by longer continuance of this condition, the tissue shrivels up, becomes unyielding, is to a certain degree atrophied, according to the same law that the intestine below an artificial *anus*, or a vessel which no longer contains blood, shrivels up, grows together, and at last wastes away. The rest of a muscle, when its contraction has once taken place, is therefore continual, because all voluntary motions which the patient attempts with the curved part, can occur only in such one way and direction, that thereby no outstretching and extension, but only a greater shortening of the contracted muscles, can be effected. A close observation of the motions in curvatures, especially in the feet, shows this remarkably. It is clear, that under such circumstances, the nervous influence and nourishment must be diminished in the muscles, and the diminution of the nervous influence may increase up to actual palsy, although the contraction of the muscle continue. In this way also is explained the reason why in palsy, which originates from the brain, and loss or diminution of the voluntary influence depending on the muscles, the muscles are contracted, whilst in palsy, proceeding from the spinal marrow, they are lax and atonic. Spasm, produced by topical causes in the muscle itself, or by reflected activity of the spinal marrow, may be the first origin of contraction of the muscles, and of the curvature thereon depending; but the continued contraction of the muscle is not to be considered as a consequence of *continual* spasm, but of the sustained rest of the muscle, and its diminished voluntary action. The same is observed in inflammation, and in all painful affections when certain muscles are kept in a continued quiet state. The most direct proof of this opinion is given by the bearings of the limb, if its natural direction be restored, in which case the recapability of motion, and the voluntary influence again gradually returns, and in the same measure, the nutrition of the muscles is increased, and their bulk enlarged, as I have especially observed, after the cure of curvatures by cutting the tendons.

(1) GUÉRIN (*a*), who, in all contractions assumes a convulsive retraction of the muscles derived from the brain, whence ensues an indisposition to the growth of the skeleton, change of bulk and fibrous degeneration disturbed functions, supposes that muscles, which by other causes have been relaxed and shortened, do not exhibit the hardness and fibrous degeneration, as the former contract, but these are disposed to fatty degeneration.

1328. The natural connexion of bones may be disturbed by rickets, *osteomalacy*, scrofula, venereal, cachectic diseases, inflammation, suppuration, and so on. The softened bones are then exposed to the action of the muscles, and drawn according to the direction of the force acting upon them ; or the weight of the body is sufficient to curve them ; from which latter cause such curvings most frequently happen in the trunk and the bones of the lower extremities.

Frequently do the just-described causes occur at the same time, and in inverse proportions ; the curvings, however, most commonly arise out of unnatural activity of the muscles.

1329. As to the *prognosis* of curvatures, all depends on their extent and how long the curvature has existed, and in how far the causes originating them may be got rid of. The younger the subject, and the less the curvature, so much the more favourable is the *prognosis.* In older subjects, and long-continued curvature, the treatment is always protracted, and in many cases, often only an aggravation of the disease can be prevented. When in curvatures at the joints, organic changes of the bones, destruction, *anchylosis*, and so on exist, the disease is incurable. Curvatures depending on muscular contraction, generally allow a better *prognosis* than those from diminished connexion of the bones. But if the muscles have become so wasted by long-continued curvature that their lengthening can be of no use, which is however difficult to determine, they are incurable.

1330. The *cure* of curvatures depends on the removal of the causes, and the restoration of the natural direction of the curved parts. When the firmness of the bone is altered, such remedies must be employed as therapeutics have pointed out as fitting to the special diseases which cause the changed coherence of bones, together with the simultaneous employment of suitable contrivances and apparatus by which the straight direction may be restored. Mere mechanical treatment is entirely useless if the diseased state of the bony system be not removed.

1331. If the origin of the curvature depend on the disturbed equilibrium of the muscular activity, the treatment must be directed according to the different causes. Usually rubbing suppling remedies into the shortened and contracted muscles, and spirituous rubbings into the stretched and lengthened muscles are recommended ; but from these remedies there is really less benefit than from the motion and extension of the contracted muscles which arises from their application. As with long-continued curving, the nervous influence is diminished in the contracted and shortened muscles, and a lessened activity of the nerves of

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(*a*) Gazette Médicale, April, 1838. No. 14.

motion is accompanied with a certain degree of curvature and wasting, so may sharp irritants, vesicatories, and even moxas, act beneficially in quickening and increasing the vitality, which remedies are especially indicated in actual palsy. In reference to this object, kneading, rubbing, and stretching the muscles, are very serviceable; but above all, suitable *gymnastics*, (with careful regard to the somewhat necessary improvement of the general state of health,) as first introduced by DELPECH (*a*). Slighter degrees of curvature may be got rid of by these remedies alone; but if the curvature be greater, they must be accompanied with the application of suitable machines and apparatus.

1332. If with long-continued curvature from shortening of the muscles, such change of their tissue have been produced, that by the treatment proposed it can be removed either with extreme difficulty, or not at all, the subcutaneous cutting through the shortened muscles, or their tendons and *aponeuroses*, (*myotomia*, *tenotomia*,) if possible, is the most proper remedy. Between the two ends of the divided tendon which retract, the upper more strongly than the lower, blood is effused, which coagulates and unites with the whole internal surface of the wound, and especially with the ends of the tendon. Exudations of plastic lymph soon occur, particularly from the ends of the tendon, presenting whitish thread-like streaks, running from one to the other, and gradually form a mass resembling fibrous tissue, which is capable of due extension, and sufficiently strong to answer the function of the muscles. This operation is therefore especially indicated under the above-mentioned conditions, if there do not at the same time exist such considerable changes in the bones, and from the long continuance of the disease, such a degree of wasting in the muscles, and the whole limb, that by the mere lengthening of the muscles, the restoration of their natural position cannot be effected, which however it is often difficult previously to determine, and when the causes giving rise to the contraction, gout for instance, still exist. The various objections made to this operation, the repeated shortening of the tendons by the gradual contraction of the newly formed intersubstance, as observed in every scar, as well as the injury to the natural direction and motions of the part from excessive activity of the antagonizing muscles, are without foundation, and contradicted by the large experience of modern times. The pain and wound are in this operation usually slight, and no particular symptoms occur. If in rare cases such be observed, as violent inflammation, with destruction of the cellular tissue, exfoliation of tendons, and so on, they must be ascribed rather to the peculiar relations of the constitution of the patient, or to the proceedings in the operation and the after-treatment, than to the operation itself. The straightening of the part, and the stretching of the tendons by proper apparatus, is most properly commenced some days after they have been cut through, when the external wound is healed, to which time a light bandage covering the part keeps it in a proper position. The employment of extension immediately after the division is improper, as thereby the two ends of the tendon are too far separated, and bad symptoms may be brought on. Too late use of extension when the intermediate substance has a trained firmness, renders the lengthening difficult, and even impossible.

The division of shortened muscles and tendons, early employed on the *m. sterno-*

(*a*) De l'Orthomorphie par rapport à l'espèce humaine, &c. 1828. Paris and Montpellier, 2 vols. 8vo. atlas, 4to.

cleido mastoideus in wry neck, (Roonhuysen, Meeckren, Ten Haaf, and others,) and then forgotten; again revived by Sharp, by Tilesius, and Sartorius, upon the Achilles' tendon in club-foot, by Michaelis extended to other tendons also, were subsequently little thought of, and only employed in certain cases of contraction, by Dupuytren and Dieffenbach in wry neck, and by Delpech employed in horse-foot as a *subcutaneous* division. But more recently, it has been first brought into practice as a subcutaneous division by the large experience and observation of Stromeyer; and by Dieffenbach, Stöss, Duval, Scoutetten, Bouvier, Pauli, myself, and many others has it been variously practised and extended to different muscles, as more attention has been paid to the special treatment of curvatures. The mode of cure of tendons thus divided, Delpech formerly, and in modern times more especially, von Ammon (*a*), Duval, Bouvier, and others (*b*), have explained by experiments on brutes.

I.—OF WRY NECK.

(*Caput obstipum, Cervix obstipa, Obstipas, Torticollis*, Lat.; *schiefe Hals*, Germ.; *Torticolis, Obstipité*, Fr.)

Mauchart, Dissert. sistens caput obstipum. Tubing., 1737.

Rettig, H. X., Dissert. sistens caput obstipum. Budæ, 1783. 8vo.

Gruve, G., Dissert. de capite obstipo. Traj. ad Rh., 1786. 4to.

Clossius, C. F., Ueber die Krankheiten der Knochen. Tubing., 1798, p. 254.

Richter, Anfangsgründe, vol. iv. p. 256.

Jörg, J. C. G., Ueber die Verkrümmungen des menschlichen Körpersund eine rationelle und sichere Heilart der selben. Leipz., 1816; with six plates.

Stromeyer, L., Beiträge zur operativen Orthopäedic. Hannover, 1838.

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Phillips, Ch., M.D., De la Ténotomie sous-cutanée, ou des Opérations qui se pratiquent pour la Guérison des Pieds-bots, Torticollis, &c. Paris, 1841. 8vo.

Bonnet, A., Traité des Sections tendineuses et musculaires, etc. Paris, et Lyons, 1841, p. 581.

1333. *Wry Neck* consists in such distortion of the neck, that the head is inclined forwards, aside, downwards, frequently even to the shoulder; and the face turned more or less to the opposite side, and at the same time forwards and upwards; the chin raised proportionally higher, as the head is in a greater degree drawn down. The patient can, under these circumstances, move the head either not at all, or only in a slight degree; often can it be done only by the assistance of another, and frequently it is not in any way possible. This disease may originate in an irregular activity of the muscles of the neck, especially of the *m. sterno-mastoideus*, in a large unsightly scar, or in a distortion of the neck itself. When long continued, there is always dissimilarity in the two sides of the face.

Distortion of the neck, as consequent on inflammation and suppuration of the joint-surfaces of the *vertebræ* of the neck, has been already considered (*par.* 263.)

1334. The most frequent *cause* of wry neck is unnatural muscular activity. It is either congenital and depends on irregular position of the child in the womb (1); or it arises from violence during delivery, which affects the *m. sterno-mastoideus* (2); or it comes on later from the habit always hanging the head to one side, especially in children, if they be constantly carried on one arm; if, on account of the continuance of any

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(*a*) De physiologiæ tenatomiæ experimentis illustrat. Dresden, 1837.

(*b*) Pirogoff, N., Ueber die Durchschneidung der Achilles'sehne als Operativ-orthopädisches Heilmittel. Dorpat, 1843; with seven copper plates. 4to.

pain in the neck it be inclined to one side (3), by spasm and organic change in the structure of the *m. sterno-mastoideus.* If the cause lie in the unnatural activity of this muscle, it is always found, on the side to which the head is drawn, stretched like a cord, hard and unyielding; in attempting to bring the head into its proper position, the muscle becomes more tense and prevents it (4). It is really only the *m. sterno-mastoideus* which is primarily shortened, and most commonly on the right side; rarely, also, the *m. cleido-mastoideus* and *cucullus;* the *m. platysma myoides*, may also be shortened. Frequently is the *m. sterno-mastoideus* of one side palsied, and the natural contraction of that of the other draws down the head. In this case the dissimilarity of the two sides of the face and the distortion of the features are not so great, as in wry neck from unnatural muscular contraction; the head is drawn only towards the shoulder, but the chin is not raised (5). That the cause of the evil is in the bones is known, when no change can be observed in the muscles, and the general symptoms of softening of bone be present. The head is also usually more movable than in the former cases (6).

(1) STROMEYER (*a*) remarks on the coincidence of congenital shortening of the *m. sterno-mastoideus* with the irregular position of the child, so that a breech-birth takes place, or turning is necessary.

(2) After difficult delivery, and after the application of forceps, a little round bluish doughy swelling above the collar-bone, corresponding to the course of the *m. sterno-mastoideus,* is frequently observed, which, after subsiding, leaves to be felt a hard thick substance, depending on partial or complete tearing of the muscle (STROMEYER, DIEFFENBACH.)

(3) I have noticed a wry neck which arose from the application of a blister behind the ear, and in a short time became considerable.

[(4) Although generally in wry neck the muscle or muscles causing it are felt contracted like a cord, yet this is not always so. SYME (*b*) mentions an instance of this kind in a boy with lateral curvature. "Observing that his head inclined to one side, I examined the sterno-mastoid, and found it, not tense and rigid as I had expected, but soft and yielding. I perceived, however, that when an attempt was made to raise the head, the muscle resisted and became tense, and therefore concluded that it was the seat of the evil." (p. 273.)

(5) BRODIE mentions (*c*) a remarkable example of wry neck alternating with insanity, among the instances he gives of persons "labouring under some disease in the brain, in whom a particular symptom, referred, perhaps, to a distant part of the body, is so severe, or so distressing, that they regard it as the original disease. * * * In many of these cases, the cause of irritation seems to operate always on the same part of the *sensorium,* and there is little or no variety in the local indications by which it is rendered manifest. At other times it has no determined seat: it may affect at first one portion of the brain to which a certain function belongs, and then it may affect another portion, whose function is entirely different, and the symptoms vary accordingly. * * * A lady became affected with a spasmodic affection of the sterno-cleido mastoid muscle, producing what is commonly called a spasmodic wry neck. This symptom continued unabated for a year, and then suddenly left her; but as the spasm in the muscle ceased, she fell into a state of mental depression, amounting to insanity; and in this she continued during the whole of the second year. At the end of this period she recovered of the disordered condition of her mind, and the spasm of the muscle returned, continuing from that period up to the time of my being consulted three or four years afterwards." (pp. 7, 8.)

(6) SYME remarks:—"It may be well to warn against mistaking for wry neck depending upon muscular contraction, the distorted position of the head which proceeds from *caries* between the *occiput* and *atlas.* The latter disease, like the former, usually occurs in young persons, presents to a careless observer similar symptoms, and if

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(*a*) Above cited, p. 131.

(*b*) On Lateral Curvature of the Spine and the cases in which it may be remedied by operation; in London and Edinburgh Monthly Journal of Medical Science, vol. iii. 1843.

(*c*) Lectures illustrative of certian Local Nervous Affections. London, 1837. 8vo.

confounded with it, leads to treatment not only useless, but extremely dangerous. (p. 273.)]

1335. The *prognosis* in wry neck depends especially on the cause and duration of the ailment. In young persons, if the cause be in the muscles, the *prognosis* is always favourable; and this applies also, under similar conditions, from curvature of the bones. But, if by long continuance of the ailment, the *vertebræ* of the neck have undergone a change of form, or have become united by adhesion, which may be ascertained by careful examination with the fingers, and simultaneous movement of the neck, the ailment is incurable.

1336. The *cure* of wry neck varies according to its causes. If dependent on unnatural activity of the muscles, it must be attempted to relax the contracted *m. sterno-mastoideus*, by rubbing in suppling remedies, as well as by exciting contraction of the relaxed muscles on the other side by volatile, strengthening rubbings of aromatic spirit, arrack, rum, and the like, and even by the employment of electricity or galvanism. After rubbing, attempts must be made to stretch the shortened *m. sterno-mastoideus*, and at the same time, to bring the head straight, which manipulation must be continued for a quarter or half an hour, during the day, till the head have been brought to its natural place, and even bend somewhat to the opposite side. The patient must also be permitted frequently to turn his head aside.

For the purpose of keeping the head straight, various apparatus and machines have been proposed, for instance, that of LE VACHER, with alteration by DELACROIX (*a*), KOHLER's cap, and others. JÖRG's (*b*), apparatus, however, seems to answer the purpose best; it consists of a head-band and stays, on the front of which is attached a spring, from whence a strap carried round the neck and fastened behind the ears in the region of the mastoid process, is fastened to the head-band. This apparatus may be worn day and night, and the manipulation may be also continued. As the head, though thereby straightened, is still however held somewhat forward, towards the end of the cure the band must be carried beneath the arm of the ailing side, go up through a ring, and be fastened at the place mentioned. The apparatus must be worn (latterly only for some hours in the day) till the antagonism between the two sterno-mastoids is perfectly restored. DELPECH (*c*) recommends a stretching apparatus, when in bed, and drawing the head by means of a loop fastened to the head and to the side of the bed.

1337. But if, when the disease have already existed for some time in a certain state, this treatment have no result, it is extremely irksome and tedious; the division of the *m. sterno-mastoideus* then leads more speedily to the object, and is, indeed especially, the only cure in all cases where, by the continuance of the ailment, organic changes occur in the structure of the *m. sterno-mastoideus*, which render all lengthening by the proposed treatment impossible. The reasons which have been brought against this operation, rejected unconditionally by JÖRG, are quite untenable; the operation is free from danger, accompanied with little pain, and the result is quick, even after the disease has existed twelve or sixteen years, or even longer.

(*a*) GERDY, P. N., Traité des Bandages et Appareils de Pansement. Paris, 1826. 8vo. et atlas 4to.—VON FRORIEP's Kupfertafeln, pl. clxix.

(*b*) Above cited, pl. ii.

(*c*) Orthomorphie, vol. ii. p. 209.

ROONHUYSEN (*a*) and TEN HAAF (*b*) cut through the *m. sterno-mastoideus* from without inwards, with a fold of the skin raised. VON MEECKREN (*c*) effected the division with a pair of scissors; MINNIUS (*d*) first destroyed the skin over the muscle with caustic, and then cut it through with scissors. SHARP (*e*) made a transverse cut through the skin, and divided the muscle from within outwards with a knife introduced behind it. This treatment was recommended by all the later writers, till DUPUYTREN and DIEFFENBACH (*f*) proposed the subcutaneous division of the muscle, in which manner the operation has been performed with the most successful results, by many Surgeons and by myself.

1338. The subcutaneous division of the *m. sterno-mastoideus* is performed in the following manner. The patient sitting on a stool, one assistant draws the head to the opposite side, and another pulls down the shoulder of the ailing side, in consequence of which the muscle projects strongly at its shortest part. The skin above it is then taken hold of with the thumb and forefinger of the left hand, well drawn away from the parts beneath, and a *narrow, slightly convex, straight knife*, held flat, is to be thrust an inch or two above its lower insertion, through the skin, and carried close behind the muscle, to the other side beneath the skin, but without piercing the latter. The edge is then turned towards the muscle, and the thumb of the left hand being placed on the muscle, to fix it against the edge, the muscle is divided, without cutting the skin, in drawing out the knife. At the commencement of the division of the muscle, a dull and sometimes tolerably loud crack is heard, upon which the head is often immediately drawn straight by the contraction of the *m. sterno-mastoideus* on the other side; but sometimes the old position is retained, and even more strongly. At the moment when the knife is drawn back, if pressure be made with the thumb upon the part divided, and no blood be poured out beneath the skin, a firm compress of lint is to be applied, and fastened with sticking plaster, and a bandage carried obliquely over the neck and breast. Two cloths carried round are sufficient to support the head; they do not, however, keep it straight, but leave it in its early oblique position.

The choice of place for dividing the *m. sterno-mastoideus* (fixed by LATTA at half an inch, and by DIEFFENBACH at two inches above its insertion) is indifferent, and must be guided by where the muscle can be isolated safely; however, the deep division at the tendinous part is more preferable, because it is liable to less reaction than the division of the muscle.

I use a straight, narrow, *slightly* convex knife, because it acts more surely and correctly than a knife with a concave edge; and, like DIEFFENBACH, I make only one thrust, in which he uses a narrow sickle-shaped knife, much curved at its point. STROMEYER, who has frequently performed the division of the *m. sterno-mastoideus* from before backwards, employs for the purpose a narrow curved knife, with its convexity cutting, which he thrusts through a fold in the skin, an inch broad above the collarbone, and by the entrance of the knife divides the muscle. For those cases where the muscle cannot be sufficiently isolated, he has proposed a peculiar forceps-like instrument (*g*).

1339. Ordinarily the division of the *m. sterno-mastoideus* is sufficient; but if the *m. cleido-mastoideus*, or a *cleido-mastoideus secundus*, (STROMEYER,) or the clavicular portion of the *m. cucullaris* be shortened, the

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(*a*) Heilkuren. Nürmberg, 1674, vol. i. No. 22, 23.—BLASII, G., Observat. Med. rar. Amstelod., 1677, pl. ii. No. 1.

(*b*) Abhandlungen aus der Naturgeschichte, praktischen Arzneikunde und Chirurgie; aus den Schriften der Harlemer und anderer Holländischen Gesellschaften gesammelt. Leipzig, 1775, vol. i. p. 262.

(*c*) Wahre und wunderbare chirurgisch und geneeskünstige Anmerkungen. Nürnberg, 1675.

(*d*) TULPII, Observationes Medic.

(*e*) Treatise on the Operations of Surgery. London, 1740. chap. xxxv.

(*f*) RUST's Handbuch der Chirurgie,—Art., *Caput obstipum.*

(*g*) Above cited, pl. viii. f. 1, 2.

division must be effected with a straight or convex narrow bistoury, or with STROMEYER's instrument, according to the rules given above.

1340. If the patient be kept quiet, in the horizontal posture in bed, and on antiphlogistic diet, generally no further symptoms occur. After some days the external wound is healed. The muscle, at the place of its division, usually presents a slight swelling; frequently also a slight fluctuation of blood is felt, in which case, according to DIEFFENBACH, sticking plaster should be applied anew somewhat tighter, in order to promote its absorption, which is usually effected in a few days. Applications of warm lead wash, and rubbing in warm oil to get rid of the last tension, are generally superfluous. If *pus* be formed, it must be discharged by a puncture, and the wound treated simply. A pasteboard cravat of half the usual height, folded in a cloth, and applied on the side of the division is, according to DIEFFENBACH, more serviceable in preserving the straight posture of the head than all violent extension, on which point I, from experience, entirely agree with him.

STROMEYER (*a*) considers that only by a stretching apparatus (pl. vii.) are we in a position to obtain all the advantages of the operation which can be attained, because only in the horizontal posture can the muscles of the neck be completely extended, and it is only possible to stretch the head towards the diseased side for the purpose of giving the *m. sterno-mastoideus* its whole length, and enabling it again to extend itself. He therefore puts it as a question whether, in very bad cases, it be not advisable to begin the extension directly after the operation, in order to avoid a repetition of the division.

If after perfect replacement, the freest motion of the neck be again given, and complete similarity of the sides of the face obtained, yet is it observed in some cases, that at the moment when the muscular system is not in action, the head is somewhat disposed towards the ailing side, manifestly because there the *turgor vitalis* is less. STROMEYER does not know whether this be entirely lost in age. Spirituous rubbing seems to him to contribute somewhat to the diminution of this relaxation, but above all, the continued use of the stretching apparatus, some time after the subsidence of all resistance.

1341. If the cause of wry neck be spasm of the *m. sterno-cleido mastoideus*, in which case the ailment is always more or less painful, accompanied with radiation of the pain, according to the branchings of the nerves, and often alternating, it must be inquired whether or not any internal cause be in play, against which the treatment should be directed, and antispasmodics employed both internally and externally. But if the contraction have at once become permanent, in general all internal and external treatment is fruitless, and cutting through the muscle is the only means whereby not merely the straight direction of the head is restored, but also the painful and spasmodic affections are removed.

Compare the interesting observations hereto belonging of STROMEYER (*b*) and AMUSSAT (*c*).

A spasmodic affection of the *m. platysma myoides*, with radiation on the face and ear of the affected side, was perfectly cured by GOOCH (*d*) by a transverse division of the muscle beneath the jaw, after he had laid it bare with a transverse incision of the skin across its breadth.

1342. If large scars be the cause of wry neck, their mere division is usually of little use, and the evil may thereby be even increased. The whole scar, together with the thickened and adhering cellular tissue must be removed, and where possible the quick union of the edges of the wound brought about. During and after the treatment, the head must be kept in a proper position. With slight superficial scars only, its straight

(*a*) Above cited, p. 130.

(*b*) Above cited, p. 137.

(*c*) Gazette Medicale, December, 1834, 829.

(*d*) Cases and Practical Remarks in Surgery, vol. ii. p. 83. Norwich, 1767.

direction may be often given to the head, by suppling remedies which are to be rubbed in, and by the bandages prescribed.

1343. If the cause of the wry neck be in a bending of the neck-*vertebræ*, and if it be unaccompanied with *anchylosis*, or change of structure, the above-mentioned apparatus must be used for the gradual straightening of the head.

II.—OF CURVATURES OF THE SPINAL COLUMN.

(*Incurvationes seu Distortiones Columnæ Vertebralis*, Lat.; *Verkrümmungen der Rückensäule*, Germ.; *Courbures de la Colonne vertébrale*, Fr.)

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Pauli, F., Ueber den grauen Staar und die Verkrummungen. Stuttg., 1838. 8vo.

Stafford, R. A., Two Essays on Diseases of the Spine. 1. On Angular Curvature of the Spine and its Treatment. 2. On the Treatment of Lateral Curvature by Gravitation, Lateral Exercise, &c. London, 1844. 8vo.

1344. The spinal column may be curved at any one part, and, according to the direction in which this occurs, are distinguished, *first*, the *lateral Curvature (Scoliosis)*; *second*, the *posterior (Humpback*, *Buckel*, Germ.; *Gibbus*, *Cyphosis)*; *third*, the *Anterior Curvature (Lordosis.)* The spine never deviates according to either of its natural directions, but always in an opposite one. At the same time it is therewith more or less twisted, and this again in a contrary direction. It is evident that the intestines contained in the chest and belly, must consequently have their natural position variously altered, and only the successive origins of these curvatures render it comprehensible, how these intestines are often so considerably displaced, without great disturbance of their functions. The curvatures of the spine have no effect on the transverse diameter of the *pelvis*, if unfounded in general disease, especially rickets or *osteomalacy* (*a*).

This opinion, advanced by Meckel, and supported by numerous facts, which, in consequence of careful observation, I hold to be correct, has been denied by Jörg (*b*) and Choulart (*c*) in so far as they assume, without any general disease of the bones, a decided influence of the curvature of the spine upon the form of the *pelvis*, only that in general disease, or, if the curvature have existed from youth, it is more decided. According to their view, as the spinal column has four natural curves, (at the neck convex forwards, at the back convex backwards, at the loins convex forwards, and on the rump-bone convex backwards,) in all cases where the natural curve increases at any one spot, the other natural curves should also be increased; just as, on the contrary, when the curve takes place in the opposite direction, the other parts of the spine also have their natural curve assume a contrary direction; in consequence of which the rump-bone becomes more curved, or more flattened. In lateral curvature the *pelvis* is always narrowed obliquely by the inclination of the rump-bone toward the one or other side. See also on this subject Rokitansky (*d*).

1345. The *inclination of the spinal column to one side*, *(Scoliosis,)* produces at first a different condition of the shoulders, and one becomes higher than the other; the body is disposed towards the side opposite the curvature, the one side of the back is full, the other concave, and more hollow; and upon it, between the last false rib and the hip-bone, is observed a small fold of the tegument, which increases proportionally as the curvature of

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(*a*) Meckel, J. F., Handbuch der menschlichen Anatomie, vol. ii. p. 740.—Wenzel, above cited, p. 9.

(*b*) Above cited, p. 8-26.

(*c*) Above cited, p. 15.

(*d*) Beiträge zur Kenntniss der Rückgraths-krümmungen, und der mit denselben zusammentreffenden Abweichungen des Brustkorbes und Beckens; in Oester-Med. Jahrbüchern, vol. xxviii. pt. i. ii.

the spine increases. With such increased inclination toward the side, distortion of the spine also occurs; the spinous processes are twisted toward the side of the inclination. The whole trunk is gradually bent, the ribs follow the distortion of the spine, are flatter on their concave surface, but upon their convex hinder surface are more strongly arched, are very widely separated from each other, and broader, whence a projection backwards is produced. The breast-bone is mostly oblique, and drawn towards the concave side of the curvature. If the curvature be at the upper part of the spine, the position of the shoulder-blades is much changed. Curvatures at the lower part of the spine affect the carriage of the body less than at the upper. Lastly, curvatures are produced in opposite directions, in which case one is, as it were, equalized by the other. In the highest degree the direction of the bones of the *pelvis* is changed, the one hip-bone stands higher than the other, and, under the circumstances mentioned, (*par.* 1344,) the promontory of the rump-bone may project inwards towards the one or other side, and narrow the entrance of the *pelvis*.

The higher position of one shoulder is always present in *scoliosis*, but it occurs alone, and without simultaneous curving of the spinal column, as *high shoulder* (*Humerus elatus.*) Raising up one shoulder, usually the right, by which the elevating muscles of the shoulder-blade become gradually stronger, is the result of bad habit; the lower angle of the blade-bone is raised higher than that of the other side; the hinder edge, however, of the bone remains in the same position, and only after long continuance does the shoulder-blade project especially at its angle. If both shoulders be high, which occurs from bad carriage, as a consequence of corresponding straining of both arms, in bending forwards the head, in short-sighted and old persons, the back is considerably arched, and the head in the same proportion projecting. In a higher degree always, at the same time, some inclination of the spinal column occurs.

[The most common cause of a high shoulder is to be found in the abominable practice of undressing girl's necks, as low as the hanging on of their clothes will permit. Instead of the shoulder-straps of their dress being, as they should be, fairly above the root of the acromial processes, they often, indeed most commonly, either only skirt the extreme end of those processes, and rest on the rounded upper part of the deltoid muscles. or are actually far down on the arms; in consequence of which, the dress having little or no suspension on the shoulders, is constantly dropping, and the girl to save her clothes dropping down, or at least to keep them in place, is continually hitching up the shoulder from which the shoulder-strap most easily slips, and thus the elevating muscles becoming stronger on that side, pull the shoulder permanently up, and produce a very ugly appearance. But the mischief does not stop here, for though there be really no disease in the spine, yet this constant hitching up of the shoulder, causes the head and neck to be thrown to the other side, whilst the chest is drawn out to the same side, and thus a lateral curvature of the spine is produced, and a girl's figure spoiled, for the simple purpose of uncovering her neck and shoulders as far as possible, which, as well for decency, as for the preservation of the child's health, ought to be covered. Many parents have been thus the real cause of their daughter's distortion, if not of more serious consequences; and therefore, in growing girls who have the least disposition to slip their shoulder out of their dress, most especial care should be taken to prevent the possibility of keeping up this habit, by having the dress made so high, that it cannot slip down, and then the sensation of its slipping being lost, the child no longer continues to hitch up her shoulder, and by a little attention to her proper carriage, the mischief, if not of long standing, may be got rid of.—J. F. S.]

1346. The intestines of the chest and belly are variously displaced by the higher degrees of *scoliosis*, in consequence of which the circulation of the blood in the lungs is hindered, difficult respiration, narrow-chestedness, disturbance of the digestion, and so on, arise, which thus explain the usually weakly form of the body in persons affected with such curvatures.

1347. In *Cyphosis* the spinous processes form a convex projection, and the bodies of the spinal column a curve, the concavity of which is forwards.

and, as they drop together, the upper approach the lower. At first, the head of the patient inclines forwards; in the supine posture no change is observed, except after very considerable exertion. In the second degree, the inclination of the spine remains, and is always increasing; it projects into a blunt, and subsequently into a sharp angle. If the *cyphosis* be in the *vertebræ* of the neck, breathing and swallowing are especially affected; if the *vertebræ* of the back be curved, the ribs are lengthened forwards, the breastbone raised, and the transverse diameter of the chest lessened, from which difficulty of breathing ensues. By the dropping of the spine, the bowels are driven down into the *pelvis*, and frequently cause difficulties in digestion. The bodies of the *vertebræ* shrink in a high degree of the disease, and they may be fixed by *anchylosis* in their unnatural position. Inclinations in other directions may, at the same time, accompany *cyphosis*.

Only in the cases where the *cyphosis* depends on *caries* of the *vertebræ* (POTT's disease) does palsy of the limb occur.

1348. The *inclination forwards* is the most rare of all the curvatures of the spine. The *vertebræ* project forwards in a convex arch, and the spinous processes are thereby approached together in a concave curve. Whence follows, that the *lordosis* can never attain so great an extent as the *cyphosis*, because the spinous processes touch. It occurs always in the *vertebræ* of the loins, and the inconveniences they excite are those of the pendant belly. It has been observed, but very rarely, in the *vertebræ* of the neck.

1349. What has been said upon the ætiology of curvature in general, applies also to that of the spine. There is either a disturbed antagonism of the muscles, or a diminished strength of the bones. The occasional causes which especially favour the various inclinations of the spine are:—

First. In *scoliosis*, careless carriage of the body in various employments, hanging on one side in writing, sitting, especially in the hand-work of ladies, increased exertion of one side, the habit of doing everything with one hand, constantly carrying children on one arm, which acts very prejudicially, as one hip-bone is always more raised and pressed than the other. The younger the patient is, the more prejudicially do the above-mentioned causes operate. If the cause of the curvature depend on unnatural activity of the muscles, they are more firm and contracted on the concave side of the curvature (which, in by far the greatest number of the cases, is the left); if the cause of the curvature depend rather on an altered state of the bones, the difference of the muscles is not so remarkable (1).

Second. In *cyphosis* the cause, for the most part, is in the bones, and the weight of the body itself is sufficient to increase the bending backwards already existing in the *vertebræ* of the back, where the *cyphosis* most commonly occurs; often is there accompanying weakness of all the muscles, which should keep the spine erect, as is frequently the case in children and old persons.

Third. In *lordosis*, in their natural state, the external muscles of the loins are more powerful than the internal; whatever therefore increases the strength of the former, increases also the natural bending inwards of the *vertebræ* of the loins, as long standing with the upper part of the body bent back, great bending back of the upper part of the body in the usual carriage, bearing heavy burdens. *Lordosis* is therefore more frequent in men than in women.

(1) Stromeyer (*a*) supposes that *scoliosis* arises, if not in all, at least in most cases, from one-sided palsy of the inspiratory muscle, viz., the *m. serratus magnus*. The muscle, although still capable of voluntary motions, takes no part in those of breathing, which is especially observable if the motions of the *diaphragm* be restrained by pressure on the belly, and the external muscles of inspiration be excited to increased activity; as then the muscles of the palsied side remain quite quiet. This imperfect palsy is derived from the palsy of Bell's respiratory system, from an incapacity of the affected nerves proceeding from the periphery to reexcite reflected irritation, in which case they still obey the stronger stimulus proceeding from the will. The greater number of cases produced in support of this opinion, permit also another explanation, and, according to what has been already said upon the ætiology of curvatures in general, is this state of palsy of the muscles of inspiration to be considered, not as a primary, but as a secondary state.

According to Gunther's (*b*) observations, in snake-like *scoliosis* the muscles neither of the concave or convex side are much wasted, nor are they changed in form, although it so appears as long as they are attached to the body. They are only either stretched where passing over the projections, or folded when lying in the concavities. On the contrary, there appears a decided difference in the strength and weight of the corresponding muscles of the two sides, and that muscle increases which has an unfavourable position, and is therefore required to act with more power. So, for instance, the *m. cucullaris* of the concave side exceeds that of the convex about 90 grs. in a weight of 1550 grs.; the *m. latissimus dorsi* of the convex that of the other side about 120 grs. in 1160 grs. If the relations of one muscle be so disproportionate that, in its natural circumstances, it either act not at all, or irregularly, its circumstances change, so that it detaches itself from some places, attaches itself to others more suitable, or forms new heads.

[According to Zink's opinion (*c*) *scoliosis* generally commences from the fifth to the eighth year of age, and between the third and fifth dorsal *vertebræ*, and the deviation is almost always towards the right shoulder-blade; that shoulder exhibiting an excess of nutrition over the left, which is especially apparent in the blade-bones themselves. Such children have a remarkable tendency to lean towards the weaker side, while on every occasion requiring muscular exertion, they prefer the stronger hand. "From repeated observations," says Zink, "I am convinced that the greater part of the mischief here detailed, is effected during sleep, and consequently, is in operation during one-third of the patient's daily existence. The heart then leans down towards the left side, and the lung on that side is compressed, one lung only (the right) performs its full office, and the muscles of respiration on that side are in a state of activity, greatly exceeding that of the left. I have also ascertained that the convexity of the deviation of the spine accords exactly with the insertion of those muscles which are most active in the process of respiration. This deviation from the perpendicular, so high up in the spinal column, is often overlooked, and the inferior and secondary contortion to the left side in the lumbar *vertebræ* is often regarded as the primary affection." And he further observes:—"This disease is more frequent among the wealthy, and more commonly in females than males."

Syme (*d*) observes:—"There is one particular condition of lateral curvature certainly not common; yet, judging from the number of cases that have fallen within my own observation, I should say not extremely rare, in which complete relief may be afforded by the division of a muscle, and in no other way. I allude to spinal curvature depending upon wry neck, caused by contraction of the sterno-mastoid. This muscle is liable to contraction both spasmodic and permanent. The former does not, so far as I have seen, affect the shape of the spine, and in two cases treated by division, did not yield to the operation. But the latter is apt to produce lateral curvature in every degree, and may be remedied with no less ease than certainty by subcutaneous incision." (p. 271).]

1350. The special *diagnosis* of curvatures in regard to their cause, is now to be considered. Great muscular weakness, resulting from previous disease, disturbed digestion, disturbed sexual development, and the like, by which gradually the joints of the spine are left to the unaided and inadequate strength of the ligaments, is characterized by weakness of the muscles, pain, and weariness of the spine, speedy tiring after every move-

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(*a*) Ueber Paralyse der Inspirationsmuskeln. Hanover, 1836.

(*b*) Pfaff's Mittheilungen, 1836, pt. ix. p. 10.

(*c*) Verhandl der K. K. Gesellschaft der Aerzte zu Wien, 1842–43; and British and Foreign Medical Review, vol. xix. p. 370. 1845.

(*d*) Above cited.

ment, dropping of the spine to one side or other, or forwards, and great mobility of the spine; so that, on examinination in various positions of the body, alterations appear; when lying down, the deformities disappear, if they be not very great. In children who are very stout, and have a large head, whose muscles are too weak for the weight of their body, and especially of their head, there appears commonly at the time when they should begin to walk, incapability of so doing; and, when sitting, a great dropping forwards of the head, by which the spine projects backwards in a large curve; in lying down, this is diminished, but, with carelessness, it becomes permanent, and always more considerable.

1351. The swelling of the fibrous intercartilage has been considered by Delpech (*a*) as no rare cause of spinal curvature; it proceeds generally from one point to all the *vertebræ* in various degrees, or all may be at once attacked. In the former case sometimes severe, sometimes slight pain occurs at any one part of the spine, which consequently is deformed. This pain has not, however, always a definite and precise place: the patient points out the seat of pain in a vague manner, frequently on one or other side of the body, frequently at the *epigastrium.* A curvature appears, which, at first, is inconsiderable, and forms a pretty large curve. The direction of the inclination is determined by the greater or less thickness which one or several fibro-cartilages have obtained at any one part of their extent. Hence may arise curvatures backwards, forwards, and especially sideways. If a complication exist at the same time, for instance, a too short lower limb, a deforming scar, long-continued pain, a forcibly-continued position, and so on, they may determine the direction of the inclination. This is, at first, slight, indefinite, and even transitory; it subsides, at least partially, in the horizontal posture, in the morning, immediately on getting up, and so long as the principal functions, especially digestion, are carried on satisfactorily. The curvature extends to the neighbouring *vertebræ.* These new curves disappear in the horizontal posture, and when the body is supported on the hands, whilst the primitive curves still exist. Subsequently these successive curvatures become permanent, and no longer subside in the experiments just mentioned. Sometimes walking and standing are rendered difficult by the curvature; the patient resorts to particular attitudes to keep himself upright, and, in a short time, new deformities are observed in the opposite direction, for the purpose of restoring the equilibrium of the body. These new curvatures may also subsequently become permanent. The curvatures form, at least before they are yet very old, more or less open, but regular arches.

If the swelling attack the fibrous inter-cartilages all at once, (cases which have been noticed by Delpech only in lymphatic and weakly persons,) the patient is not capable of standing upright; he always seeks a resting-place, loves repose, is apathetic, but yet restless; he avoids all exercise and all enjoyments of his age; the slightest walking tires him. Generally there appear disturbance of the digestive organs, palpitation of the heart, and oppression of the chest, which, however, are transitory. The patient avoids bending himself in any one direction; and in the most simple, and shortest walks, has frequent falls, accompanied with pain, which ceases as quickly as it came on, and the seat of which the patient cannot accurately determine. If sufficient pressure be made successively on the spinous process of each *vertebra*, violent pain is excited in each, and an

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(*a*) Orthomorphie, vol. ii. p. 53.

epileptic attack, accompanied with convulsive movements of the upper and lower limbs. If the examination be made whilst the patient stands, epilepsy follows, with the painful sensation produced by pressure. On examining the spinal column, it is easily perceived that a greater or less mobility exists in almost all the *vertebræ*, but especially in those in which the pressure causes the symptoms mentioned. There still, however, appears no permanent deformity; but if the patient be carefully suspended by the head or by the arms, all appearance of deformity subsides, and it is clear that all are possible, but none yet exist which may become permanent. If the ailment continue to permit it, successive and alternate fixed curvatures occur, which quickly increase, but always retain their fundamental character, to wit, a greater or less large arch, generally of pretty large extent, but regular, and free from all angles. These curvatures very readily increase.

1352. In the curvatures of the spinal column from softening of the bones, the spine usually projects backwards where one or several bodies of the *vertebræ* have sunk in, and a vertical flattening of the body of a *vertebra* takes place. The bending backwards is frequently connected with a slight disposition towards the side. At some distance from the original curvature, large curves and almost regular arches are formed. In rickets there are accompanying swellings of the condyles of the tubular bones, which also bend in various parts, disturbance of digestion, distended belly, and so on. In *osteomolacy*, the whole constitution is much affected for a long while before the curvature takes place, severe, commonly wandering pains, spreading over the breast and belly, frequently fixed in the spine, which increase at every movement, even on turning round in bed, precede and accompany curvature; febrile symptoms frequently appear; digestion and all the functions become more and more affected; the weakness is always greater, and partly on that account, partly on account of the pain at every movement, the patient keeps one position in bed, which determines the direction of the inclination of the spine. In these curvatures the ribs especially, and the bones of the *pelvis*, are decidedly changed in their form and direction.

1353. The *prognosis* in curvatures of the spine, is directed generally according to the age of the subject, the duration, the cause, the degree, and complication of the disease. Many curvatures which, as yet, have not become permanent, and are connected with general disturbance of the health and weakness of the muscles, may, indeed, in rare cases subside, form favourable change of the constitution during the period of development, or from accidental improvement of the general state of health; but reliance on this self-assistance of nature is always dangerous; for, in most cases, experience commonly shows the case getting worse. The younger the patient, the slighter the degree of curvature, so much the easier is it of cure; in persons advanced in years, and in adults, the progress of the disease may be arrested by careful treatment, but no perfect cure is effected. If the cause of the curvature be a diseased condition of the bones, the *prognosis* is always more unfavourable than if it were in misproportions of the muscles. If inclinations of the spine, in different directions, exist, the treatment is more difficult than if there were merely one single inclination. In long continued curvatures of the spine, such changes occur in the *vertebræ* that a cure is rendered impossible. It is therefore an important observation, in reference to this point, that the curvature remain without increase some two or three years, and still more important, that for an equally long time, all the vague symptoms of inexplicable injury of functions, which accompany the completion of the deformity, are progressively and completely stopped (*a*). In these cases the curvature is connected with *anchylosis* of the *vertebræ*, and the cure is impossible. In order to ascertain this, the patient, having stripped, should be laid flat on his belly, and rubbed with spirituous remedies on the extended muscles, but with relaxing remedies on those which are contracted, and attempts should be made to restore the spine gradually to its natural direction. If the patient then feel a stretching and stress upon the curved part of the spine, and not at the insertion of the muscles, it may be decided that there is *anchylosis.* This condition of the curvature is more surely indicated, if previous or continued extension of the spine show no change in the curvature. On the other side, if changes in the spine be observed on carefully lifting the body by the head (1), so that the feet do not support the weight of the body, or in extension whilst in the horizontal posture, there is more hope of restoration. *Anchylosis*, however, is not very common, and usually only accompanying a long continued great degree of curvature, and in persons of advanced age. The *scoliosis*, when it first occurs in adults, rarely attains the first degree. The *lordosis* is most easy, the *cyphosis* the most difficult of cure.

[(1) This practice of lifting by the head, to which CHELIUS very frequently recurs in these diseases, I think very objectionable and dangerous, especially in weakly children, who may be entirely free from disease, as the longitudinal ligaments of the spine may be insufficient to bear the weight of the lower part of the body. ASTLEY COOPER, in his lectures, was accustomed to inveigh bitterly against the foolish trick of showing children the way to London, as it is called, which consists in lifting them up by the chin and back of the head. CHELIUS's proposal is of the same kind, and equally objectionable.—J. F. S.]

1354. The *treatment* of curvature of the spinal column must be variously conducted, according to the different cause and nature of the deformity, that is, such remedies must be employed as counteract the causes in which it originates, and at the same time, or immediately after the straight direction must be restored by mechanical apparatus and other means operating on the spine. In former times the first indication was almost completely neglected ; the treatment was, for the most part, purely mechanical, and partly thence, partly from the inadequacy of the mechanical apparatus, was imperfect, and in most cases, even hurtful. Only in modern times has this treatment become the object of careful inquiry, and employed on right principles, according to the difference of the causes of curvature. A survey of the various machines and contrivances which have been proposed for the treatment of the spinal curvature, give proof of this.

1355. The apparatus which have been proposed for cure of spinal curvature, act either by *pressure* or *extension*, or both together.

1356. To the apparatus, acting by pressure, belong

First. HEISTER's *iron cross* (*b*), which consists of two flat iron rods connected together in form of a ⊤. On the transverse piece are two rings, by which the shoulders can be drawn back ; at the extremity of the vertical piece descending along the back is a strap, by which it is attached to the body. B. BELL (*c*) has added to this machine a padded neck-band,

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(*a*) DELPECH, above cited.

(*b*) Institutiones Chirurgicæ, pl. viii. f. 13.

(*c*) Lehrbegriff, vol. v. pl. iv. f. 5, 6, 7.

connected to the cross by an iron rod, which may be fixed higher or lower, in order to keep the head more or less up.

Second. Van Gesscher's *apparatus* consists of a stirrup bound around the *pelvis*, on which two rods are attached with screws running upon the sides of the spinous processes, and rivetted above to a shoulder-piece, on the two ends of which are straps to draw the shoulders back.

1357. To the apparatus operating by extension, belong, first of all, the *extending beds* and *stretching apparatus* of Venel and Schreger (*a*), Lafond (*b*), Shaw (*c*), Maisonabe (*d*), Blömer (*e*), Langenbeck (*f*), Delpech (*g*), Heine, and others, in which the patient is fastened, by means of padded straps applied on the feet and head, above and below to a bed or chair, and the extension of the whole body is kept up by sufficiently strong springs. In some of these machines it is attempted simultaneously to employ pressure, by means of solid pillows thrust beneath the back, or as in the stretching apparatus of Delpech and Langenbeck, by elastic traces carried around the body from one to the other side of the bed. The same object is effected only momentarily, by the so-called *neck-swing* (*escarpolette*) of Clisson, in which a broad cloth is applied around the patient's neck, and to its two sides is attached, behind the ears, a bandage which is carried through a pulley attached to the cieling, wherewith the patient draws himself up as long as he can bear it.

Here also belongs Le Vacher's machine which consists of stays, laced in front, and having a plate attached to its hind part. An iron rod passes into a groove upon this plate, which ascends straight up the middle of the neck and thence curves over the head to the forehead. In the notch at the upper end of this rod is hung an apparatus which is fastened around the head and beneath the chin of the patient. Pelug (*h*) has improved this machine by attaching, instead of the head-apparatus, at the end of the iron rod which reaches only to the upper part of the neck, a neck-band, by which the chin and *occiput* can be held up. Sheldrake altered Le Vacher's machine ; he took away the stays and fastened the iron rod on a plate which descended from the middle of the back and fitted closely to the rump-bone. Delacroix also altered this machine, making its point of support on the *pelvis* (*i*). Guerin (*k*) has proposed an apparatus for the simultaneous extension (*extension sigmoide*) of the vertebral column in contrary directions of the curvature.

Hereto also must be referred Darwin's (*l*) advice, to keep the patient, at the onset of the curvature, for a long time in the horizontal posture, and if this be insufficient, to let him sit on a particular kind of seat, in which, by a special contrivance, the shoulders can be raised and the head supported. Blœmer and Lafond's stretching-chair (*m*).

1358. The apparatus acting by extension and pressure, are—

First. Schmidt's *apparatus* (*n*), consisting of two semicircles connected together, which lie upon the hip-bones and from whence rise up two sheaths

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(*a*) Versuch eines Streckapparates zum nächtlichen Gebrauche für Rückgrathsgekrümmte. Erlangen, 1810. 4to.; with copper-plates.

(*b*) London Medical and Physical Journal, Dec. 1826, p. 497.

(*c*) Above cited.

(*d*) Journal Clinique des Difformités, Dec. 1825, No. ii.

(*e*) Journal von Graefe und von Walther, vol. ix. pt. iv. Compare Froriep's Chirurg. Kupfertafeln, pl. clix. clxxxii.

(*f*) Muhry, Dissert. de spinæ distortionibus et pede equino. Götting., 1829.

(*g*) Orthomorphie, pl. 40, 41.

(*h*) Bernstein, Systemat. Darstellung des Chirurgischen Verbandes, p. 259.

(*i*) Gerdy, above cited. Chirurg. Kupfertafeln, pl. clxix.

(*k*) Gazette Médicale, Nov. 1835, p. 732.

(*l*) Zoonomia, or the Laws of Organic Life. London, 4to. 2 vols. 1794-96.

(*m*) Froriep's Chirurgische Kupfertafeln, pl. cxxxiv. clix. clxix. clxxxii. ccxl. ccxlvi.

(*n*) Beschreibung einer neuen Maschine zur Verminderung und Heilung der Buchel. Leipzig, 1796. 8vo.

or the reception of two rods, which at their upper part have a semicircular sweep outwards for supporting the shoulders, and are movable higher or lower. At the upper part of each sheath is a semicircle, to which two rods are attached, their upper ends thrown round the half circles, like hooks, their lower ends curved round the half circles, encompassing the *pelvis* and ascending within it. These processes, covered with leather, form long pads, which are brought close to, or separated from, the rods, by screws. Well-fitting stays surround the front of the chest. The apparatus of Langenbeck (*a*) and von Graefe (*b*) are constructed on the same principles.

Second. Jörg's *apparatus* (*c*) consists of a firm and an elastic part; the former is made of linden wood, covered with soft leather; the latter consists of several springs laid close together and covered, connected at the one end with the firm part and at the other end fastened with a buckle. In *scoliosis* the firm part is applied to the concave side of the trunk, below it rests upon the hip, and above, juts against the shoulder. The elastic half is carried round the other side (for the first degree of *scoliosis*, Jörg employs an elastic brace, which is attached to the breeches usually worn, before and behind, in the middle by a button, and passes over the shoulder of the projecting side, where a pad is placed beneath it.) In *cyphosis* this apparatus is applied with the alteration, that the firm part is always applied where the trunk is concave, and the elastic half on the seat of the projection.

A. Portal had already proposed to a certain extent a similar apparatus, consisting of a double fork, which is fastened on the sides to a pair of stays, so that the arm above and the hip below serve for its application (*d*).

The Graefean apparatus is composed—1. Of a *loin-girdle*, which by means of a pair of semilunar plates rests upon the crests of the hip-bones. The hinder ends of this girdle may be introduced into each other, and fastened with a screw. The front ends are connected with a buckle. Upon the semilunar plates are studs on both sides, on which is fastened a strap, destined to support the belly. All this part of the machine is stuffed with hair and covered with leather. 2. Of a *breast-girdle*, which like the lower one consists of two semicircles, connected behind in the same way as is the lower one; and in front, in males, fastened together by a strap and buckle; but in females, segments are applied around the breasts. 3. On the loin- and chest-girdle there are, on both sides, two rods firmly connected with the former, and with the second by a steel plate. These rods form beneath quadrangular sheaths, which terminate in quadrangular capsules, on the outside of each of which is a quadrangular prominence. In the interior of these sheaths is an endless screw, which can be raised up or depressed by means of a roller fixed on the quadrangular projection. The rest of the sheath above the quadrangular process is formed into a cylinder, in which is a spiral spring. Into the upper opening of this cylindrical part of the sheath is the rod received, having upon it the support for the shoulder, which is properly padded, and so attached to the rod that it can be differently placed, according to the different form of the shoulder. For the purpose of connecting pressure on the spine with this extending apparatus, cushions are applied, by means of screws on the breast or loin-girdle, according to the difference of place to which pressure is to be applied.

I have made the following alterations in this apparatus to render it more simple and less costly. A case of iron plate, properly padded, and enclosing the *pelvis* up to the upper spine of the hip-bone, is fastened in front with a broad strap and buckle. On both sides of this *pelvis* case are two buckles, in which two rods connected with each other are inserted. At the upper end, these rods are connected with an iron plate, through the middle of which a screw passes, quadrangular at its lower end, and at the upper, the properly padded supports are attached, which may be placed higher or lower, by means

(*a*) Bibliothek für die Chirurgie, vol. iii. pt. ii. pl. ii. f. 3.

(*b*) Malsch, G. Dissert. de novâ machinâ Graefianâ distorsiones spinæ dorsi ad sanandas nec non disquisitio deformitatum istarum. Berol., 1818. 4to.; with copper-plates.

(*c*) Above cited, pl. v. f. 1.

(*d*) Précis de Chirurg. prat., vol. i. Paris, 1761.

of a key fitting the quadrangular end of the screw; thus the apparatus acts like Graefe's. For the purpose of making graduated pressure I do not employ cushions, but elastic bands, (after Joërge's plan,) which in *cyphosis* lie upon the back, and are attached to brass studs on both rods; but in *scoliosis*, to the studs on one rod over the projecting side of the trunk, between it and the ascending rod, for the purpose of surrounding the whole body, and again is attached to the stud of the first rod. In inclination in two opposite directions, this yoke may be applied, also in contrary directions. If the shoulder-blade particularly project, I carry an elastic band over the more elevated shoulder, and fastened behind and before to that going around the body. I allow this apparatus to be worn day and night over a close shirt. From its careful employment I have derived the happiest results (*a*).

1359. It were superfluous to enter on a special criticism of the several apparatus. Those contrivances only which at once effect extension and pressure can act efficiently. Of the portable apparatus of this kind, those only answer the object which have their point of support on the *pelvis*, and are so constructed that they cause no painful pressure, nor too great compression of the chest, and so on. With proper consideration of the points still to be mentioned in reference to special treatment, the cure may indeed be effected with these apparatus in incipient and slight degrees of curvature, and specially in lateral curvature produced by unequal muscular activity, as I have so frequently had opportunity to observe in the use of my above-described apparatus, which is distinguished from that in which pressure is made by the cushions, by the lateral elastic bands. Such favourable result is, however, only possible with close and careful attention, and when, especially, all the circumstances of the patient are properly regulated. When this is not the case, the disease becomes really worse, or at least all the time is lost which could have been best employed for the cure of the deformity. For all great degrees of curvature, such treatment is insufficient; a continued employment of the extending apparatus is necessary, the operation of which is not equally certain as that of the portable apparatus, and among which that is best, in which, at the same time, bands are attached, to operate on the opposite sides of the trunk, as, for instance, in the extending apparatus of Delpech, Langenbeck, and others.

1360. Such treatment can only in reality be carried on with suitable care in special institutions for the purpose; and this is the reason why of late these (orthopedic) institutions have become so very numerous. There is, however, a well grounded complaint, that in many of them the entire treatment is conducted in a too mechanical manner; and that by too long continued use of the extending apparatus, with constant rest, the greatest injury is caused to the whole constitution of the patient; so that, as I unfortunately have seen in several cases, with slight or merely transitory improvement of the curvature, disorder of the health difficult to be got rid of, and even incurable, has been thereby produced.

Those cases are not to be now considered where the disease of the spine is of a completely different kind, and not to be thus treated.

1361. Delpech has the great merit, by combining a regular course of gymnastics with the use of the extending apparatus, of getting rid of those disadvantages which have been properly objected to on account of the above-mentioned causes, by the usual employment of the latter, and especially by the proper estimation of the operation of such gymnastics, of having opened a new and very successful path in the treatment of this deformity.

(*a*) Gruber, S. P. G., Dissert. de novâ machinâ Cheliusianâ ad sanandam gibbositatem, cui accedit hujus morbi descriptio. 1825. 4to.; with copper-plates.

1362. These gymnastics have the especial object of relieving the *vertebræ* from each other's weight for several hours daily; of supporting the weight of the body, without condemning it immediately to rest and its ill consequences; of exciting the activity of the muscles to sufficient continuance and power, so that it may be advantageous to the nourishment of these organs, and to the improvement of the whole constitution; to employ all the muscles, without exception, in increased exertion, and by means of motion, extension, and pressure, employed in all directions, to reach the affected parts of the spine. These exercises are to be used daily for two or three hours, and then, according to the state of the deformity, the necessary extension in the stretching-bed, or some special apparatus is to be employed. DELPECH considers swimming as very proper, but otherwise he does not use bathing, if no special reason call for its use; neither does he employ friction and the like, because by the exercises the muscles are acted on far more properly and more powerfully than by those means.

These exercises, which are undertaken gradually, and extended to all the muscles, are, movements upon the swing, exercises and games on the spiral ladder, exercises on the knotted rope, games on the loose rope and climbing pole, games on the obliquely-stretched rope, on the straight and obliquely-stretched ladder, games on the tight rope and flying bridge, the use of a windlas, games with the horizontal pole, and so on. The atlas accompanying DELPECH's work gives a sufficient representation of these different exercises.

Where no special institution is at hand, apparatus for these exercises must be introduced into every room, yard, or garden. I have for several years (in my private practice) employed such appropriate gymnastic exercises, in connexion with other remedies in the treatment of curvatures, with the desired results.

1363. If the cause of the curvature be in an unequal contraction of the muscles, in which ordinarily the left side sinks down, the right shoulder-blade projects, and the right shoulder is raised, it must be treated according to the general rules laid down. It is usually attempted by rubbing in suppling ointments, or oily remedies to relax the contracted muscles of the sunken side, and by rubbing opodeldoc, *spiritus serpylli c. liq. ammon. caust.*, *tinct. canthar.*, with some volatile additions, to excite the muscles of the protruding side to action. For these cases the employment of electricity, repeated blisters and the *douche* upon the side of the extended muscles, have been also recommended. In the rubbings, which are to be performed night and morning, the patient should be stretched on his belly, and they should be continued from half to a whole hour, and attempts are, in the mean time, to be made to press the spine into its natural direction. These rubbings operate certainly less through the substances rubbed in, than from the pressure, kneading, and stretching of the contracted muscles. If the nervous activity be in these cases diminished, the rubbing should be more active; spirituous remedies, and even the application of stronger irritating remedies are indicated. In incipient *scoliosis*, if care be taken that the patient carry himself properly, that the two halves of the body be equally exerted, that all faulty posture in writing and the like be diminished, that he often hang by his hands, and keep the horizontal posture in bed, upon a hard mattrass, a perfect cure may be effected. Here also well-fitting stays, with whalebone or elastic springs, will be of much use, as they properly support the body (1). In more considerable curvature, regulated gymnastic exercises, the use of a properly constructed portable apparatus, or better, the employment of a stretching apparatus, is most suitable. In these cases, the *scoliosis* does not usually affect the general state of health, and we see that the mechanical means are best endured. If the constitution be at the same time affected, corresponding remedies and suitable dietetic care must be employed.

(1) The prejudices which have been very properly made to the stays (*a*), has no reference to this determination of their employment.

1364. For the quicker cure of curvatures of the spine, depending on muscular contraction, Guérin (*b*) has proposed the division of the contracted and shortened muscles, and practised it in several cases. The muscles which he cut through were *m. cucullaris*, *rhomboideus*, *levator anguli scapulæ*, *sacro-lumbalis*, *longissimus dorsi*, and *semi spinales*. He has performed the division in persons of both sexes, and of different ages: the youngest was thirteen, and the oldest twenty-two years of age. All the curvatures were in the second and third degrees, with distortion of the spine and corresponding humps. In some a single division of the shortened muscle was sufficient; in others a second and third was undertaken. In all he obtained, immediately after the operation, a very striking degree of straightening of the spinal column; and in a man of twenty-one years of age, whose curvature had been subjected to a ten months' mechanical treatment, he effected an immediate straightening by cutting through the *m. longissimus dorsi*, and the corresponding *m. semi-spinales*, In other subjects he carried on the treatment by mechanical means with decidedly good effect. Although the subcutaneous division of the muscles of the back has been undertaken by other persons, I cannot, from the practice in question, give so decided judgment of its fitness, as the numerous and careful observations upon tenotomy in other curvatures have allowed.

[In regard to the division of the muscles for the cure of curvature of the spine Robert Hunter of Glasgow (*c*) says:—"In no instance has the operation of itself produced a cure; but in all the cases on which I have operated, with one exception, it manifestly placed the patient in a more favourable state for the performance of a cure. The operation itself appears to me to effect no more than to take off, either in part or whole, the power of muscles that are interested in maintaining the curvature, and thus placing the spine in a condition to be more easily influenced by mechanical and physiological causes. The cases which have been treated by me have all been of long standing, none less than seven years, and some ten, sixteen, and twenty years, and all with considerable torsion and gibbosity, as well as lateral curvature. * * * In some instances the section of the muscles was instantaneously followed by an obvious improvement in the state and appearance of the back; in other instances I could discover no change whatever.

"I perform," says R. Hunter, "the subcutaneous section of the dorsal muscles at four different places of the back. 1st. I weaken the tension of the deepest-seated layer of muscles—that formed by the *multifidus spinæ*, by dividing the thickest part of that muscle, as it lies comparatively superficially upon the *dorsum* of the *sacrum*, opposite the posterior superior spinous process of the *ilium;* 2nd and 3rd, I remove the tension of the middle layer of spinal muscles, that formed by the *longissimus dorsi* and *sacro-lumbalis*, by cutting these muscles across, sometimes in the lumbar region, and sometimes in the costal region, according to the circumstances of the case; but more frequently in the lumbar region. near the origin of these muscles; 4th, to destroy the tension of the flat and more superficial muscles, I divide these muscles by a longitudinal incision, close to the spinous processes of the *vertebræ*, at the place where the tension of the muscles appears to be the greatest. In one instance I cut through, with considerable affect, the *latissimus dorsi* at the side of the chest, and consequently at some distance from the spine. The muscle crossed the contracted and concave side of the trunk, and appeared to be accessory in huddling in the ribs of that side. When the patient

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(*a*) Soemmering, S. T., Ueber die Schadlichkert der Schnurbruste. Berlin, 1793.

(*b*) Gazette Medicale de Paris. 1840. No. 14, 15.

(*c*) On the Section of the Muscles in Spinal Curvature; in London Medical Gazette, vol. xxxii. 1842.

attempted to elongate that side, a cord, as thick as the little finger, was seen stretching from the crest of the *ilium* to the *scapula ;* as soon as this rigid cord of muscle was cut through, the ribs became less huddled together, and that side could be elongated to a much greater degree, and the spine materially affected. The cutting of the dorsal muscle is only the first, though an important step in the treatment of spinal deformities. The means that are afterwards employed in conducting such cases to a successful issue, are both mechanical and physiological. The first consists in the application of pressure, made in various ways, and by various means, to assist in the gradual return of the parts to their natural places; and the second, without which the first would be useless and unavailing, consists in infusing power into the muscles which have become weak or dormant from disease, by simply calling these muscles frequently, and in various combinations, into action." (p. .)

In reference to the division of "certain muscles of the back, on the contracted state of which it was alleged the distortion depended," SYME observes, "nothing could be more erroneous than this view of the case, since the muscles throughout its production and existence are entirely passive. They, from the first, do not draw the spine away, but allow it to bend, their fault being weakness, and not undue contraction, so that those requiring to be connected are seated on the convexity of the curve, instead of its concavity, and it is needless to add, could not be strengthened by division of their substance." (p. 271.)

I have not had any experience upon the subject, but am rather disposed to agree in opinion with SYME.—J. F. S.]

1365. In curvatures dependent on great muscular weakness, internal tonic remedies must be employed, as bark, acorn coffee, and the like; a strengthening succulent diet, the use of generous wines, chalybeate mineral waters, rubbing in volatile, aromatic, and spirituous remedies, steel, salt, or aromatic bathing, river bathing, and so on. In these cases the gymnastic exercises are especially effective, and, by their proper arrangement, the injuries are more certainly prevented, which otherwise are necessarily produced by rest and inactivity of the muscles, accompanied with the use of the stretching apparatus. In children who begin to walk, it is usually sufficient to rub the back and lower limbs with spirituous remedies, to prevent sitting, and to let them sleep upon a hard mattrass.

In the high shoulder attempts must be made to relax and continually depress the too violently acting muscles, by proper rubbing, proper carriage and exercise, for which purpose the one-sided breeches brace, recommended by JÖRG, is most suitable. In high back, if there be at the same time a bowing forwards of the head, the machine recommended by SHAW (*a*), is best, by which the muscles of the nape are put in greater activity, and drawing back the head is effected.

1366. If the curvature of the spine depend on softening and thickening of the fibrous inter-cartilage, the readiness with which, by extension, the direction of the spine can be changed, renders it in the highest degree proper. If, by pressure, movement between the several *vertebræ* can be brought about, there is no need of making any attempt at extension, nor of employing any other means which act forcibly on the *vertebræ*. The altered joints must first acquire more firmness. If, at the same time, there be pain, which, although not symptomatic of inflammation, leads to the belief of a passive gorging of the blood-vessels, a condition which by neglect passes on to inflammation and suppuration, leeches and cupping are to be first employed, though not to excess; afterwards rubbing in volatile camphor liniment, blisters, issues, cold *douche* bath, warm *douche* bath of salt water, of water containing sulphuretted hydrogen, even *moxas*, especially on the principal seat of the deformity. The patient should observe a quiet posture on the back, and afterwards cautiously use the easiest gymnastic exercises; for instance, the motions

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(*a*) Engravings, pl. vii. f. i., and described in his Essay on Distortions, already quoted.

with the barrow and rope. The patient's powers must be supported by a nutritious diet and proper medicines.

If the nature of this ailment be ascertained only by the horizontal posture, or by careful attempts at extension, if no other pain exist than that caused by careful extension, if it be not increased by pressure on the painful spot, and if it decrease by resting quietly on the back, the gymnastic exercises may be at once begun, with caution; then followed by the employment of extension; and lastly, the lateral bandages (*a*) may be also employed.

1367. In curvature of the spine depending on rickets, the treatment must be especially directed towards the improvement of digestion and chylification, by tonic remedies and strengthening diet; aromatic and spirituous rubbings, strengthening baths, lying in the open air upon a sand-bank, warmed by the sun, are to be employed; horizontal posture upon a hard mattrass, and subsequently, gymnastic exercises and the extending apparatus are to be carefully made use of. The treatment is similar in *osteomalacy;* bark with phosphoric acid is here especially efficient, as I have repeatedly observed. The very severe pain often occurring in these cases, must not lead to the application of leeches, and so on. Besides proper position, and support of the body in general, nothing further can be done in these cases against the curvature.

1368. If the curvature be connected with rheumatism, a correspondent treatment must be employed; and the complication having been got rid of, the treatment of the curvature must be thought about. Palsy of one or several muscles often occurs from rheumatism; in such cases, moxas, *douche* baths, purgatives long continued, and the like, are very efficient.

Curvatures of the spine, from contraction of one side of the chest, after the cure of an *empyema*, or abscess in the lungs, are incurable, and every attempt at their treatment inadmissible and dangerous. Curvatures from shortening of one of the lower limbs, may, in many instances, be prevented by a peculiar shoe and the like, by which the proper length of the limb is attained.

III.—OF CURVATURES OF THE LIMBS.

[The several portions of the lower limbs are occasionally and variously curved and contracted upon each other, either as original imperfect developments, or resulting at any period of life from different causes, which may be either inflammatory, or from paralytic affection of one set of muscles, whilst their antagonists still possess their contractile power, and, being unopposed, draw together more or less completely those portions of the limb to which they are attached. The fixedness of the limbs from either of these causes must not be confused with that depending on *anchylosis*, already considered (*par.* 224*) (*b*) in which, after more or less complete destruction of their cartilages, the joint-ends of the bones are fixed in any position they may have acquired, during the progress of the disease, by a fibrous or bony union. The cases now to be considered depend entirely upon the condition of the muscles, their tendons, and tendinous sheaths, whilst the joints themselves have their structure entirely changed, or but very little altered; and in such only can surgical treatment be of any avail.

(*a*) Delpech, Orthomorphie, vol. ii. p. 238.

(*b*) Vol. i. p. 241.

I.—OF CURVATURES OF THE LOWER LIMBS.

Curvatures of the lower, are more frequent than those of the upper limbs, although the bony and muscular fabric of the former are much more strong and powerful, partly because the weight of the body resting upon them more readily produces curvature, under the existence of favouring circumstances; and partly because in most cases, in incipient and even in advanced curvature, walking produces an injurious effect upon the lower limbs. Of the several joints of the lower extremity, curvature is least frequent at the hip, and most common, and indeed not infrequent, at the ankle, at which also it is most generally an original malformation.

A.—OF CURVATURES OF THE HIP.

Curvature or contraction of the thigh upon the belly (*Scelocampsis*, Lat.; *Angezogensein des Oberschenkels an den Unterleib*) may originate in the continued action of the flexing muscles of the thigh, whilst their antagonists are palsied from any cause, or from sympathetic affection of the former muscles, with disease of the *vertebræ*, which is sometimes consequent on *metastasis*, or from inflammation in the *m. psoas*.

The *treatment* of these cases consists in relaxing the contracted muscles by suppling applications, and in exciting the inactive or palsied muscles to action by the use of irritating remedies; and if these fail, the division of the flexing muscles, to wit, the *m. pectineus* and *sartorius* has been proposed and performed by Stromeyer (*a*), but which, as far as I am aware, although successful, has not been repeated by any one else.

In a case of metastatic inflammation of the spine following measles, in a child of ten years, in which the thigh, at first drawn close up to the belly, by yielding of the lumbar muscles after the use of tartarized antimonial ointment, blisters, and rubbing in mercurial ointment, could be drawn down to a right angle, Stromeyer divided the *m. pectineus* and *sartorius* with success. The division was made in the following manner:—One assistant fixed the *pelvis*, whilst another stretched the contracted thigh, which raised the *m. pectineus* so that the finger could be passed behind it from its outer side, an inch and a half below its origin. A strong *phimosis*-knife was then introduced upon the finger through the upper half of the muscle, dividing it, and penetrating the skin. He then cut through one half of its breadth beneath the skin, and afterwards divided the second inner and under half; and only a few drops of blood followed the four little punctures made in the operation. The *m. sartorius* was divided, by adducting the knee so as to make the muscle prominent; and having raised it with the thumb and finger of the left hand, he thrust a *phimosis*-knife through, about two and a half inches below its origin. and divided the muscle beneath the skin, the ends of which separated rather more than half an inch. The leg immediately straightened without the least difficulty, and having been kept on an extending apparatus for a fortnight, was allowed to get up, and in the course of three months walked about well. (pp. 119, 20.)

B.—OF CURVATURES OF THE KNEE.

Curvature of the knee may be either congenital or acquired, and depending on imperfect development of the muscles, tendons, and *fasciæ*, or on their shortening consequent on inflammation, either of the structures themselves or of the cellular tissue around or in the neighbourhood of the joint, or simply from inaction. This condition is to be distinguished from the curvature which almost invariably accompanies *anchylosis* following ulceration of the joint-cartilages, and which has been already considered.

(*a*) Above cited.

One knee may curve or bend inwards, producing the deformity called *In-knee* (*Genu valgum*, Lat.; *Ziegenbein*, *Schemmelbein*, Germ.; *Genou en dedans*, Fr.) or *Knock-knees*, when both knees are in like manner affected. It is characterized by a projection inwards of the inner condyle of the thigh-bone, with a less or great divergence of the leg and foot outwards, so that in standing the feet are far apart from each other, and the thigh-bones, overhanging the inside of the heads of the shin-bones, are, together with the weight of the body, supported mainly by the internal lateral ligaments of the knee-joints. The knees also, instead of being against the same imaginary plane, are placed one behind the other. When this deformity is great, walking is very awkwardly performed, as it is necessary, in bringing the leg forwards, to abduct it considerably, to avoid striking the knees together; and in consequence of the oblique direction of the leg, the inner ankle also bends inwards and the person treads upon the inside of the foot.

This is a very common ailment in labouring persons who carry very heavy weights, but is generally worst in those accustomed to wheel heavy barrows. It, however, is by no means unfrequent in young people who grow quickly, but is often recovered from, as their bodily strength improves, unless occupied with hard labour.

Little can be done for this distortion, which I have in one or two persons known to incapacitate from following any laborious employment, besides supporting bandages and cold *douche* baths. Although irons are recommended, I have not seen much benefit from them.

The knee may also be curved outwards (*Genu varum*, Lat.; *Säbelbein*, Germ ;) this is, however, rare, and must not be confused with the so-called *bow leg*, which depends principally on outward curving of the shin-bone, and to which the slight outward bend of the knee is only consequent.

The knee is, however, most commonly bent forwards, (*Contractura Genu*, Lat.; *Vorwärtsbeugung des Kniees*, Germ.,) and this may occur from original shortening of the bending muscles of the leg, or of the *fascia* covering the thigh, an account of which last was first published by FRORIEP (*a*), who found, in a corpse, that although the flexing muscles were cut through yet the knee could not be straightened. Very frequently the knee is bent at a later period of life, and the most common causes are rheumatic inflammation of the tendinous structures about the joint independent of disease of its interior, or scrofulous inflammation running on to suppuration, around or even in the joint itself. Palsy of the extending muscles may also give rise to this kind of bending of the knee.

The *treatment* of these cases consists in rubbing and in the application of extending apparatus and the use of passive motion, from patiently persisting with which for a long period, considerable benefit and occasional cure results; but in those cases which cannot be managed, it has been recommended to divide the hamstrings, an operation, I believe, first practised by MICHAELIS (*b*), who had performed it three times previous to October, 1810, and it has since been occasionally performed with varied success. The operation is performed, either by division of the hamstring tendons at once, or by partial and repeated cuts till they are completely divided, using at the same time an extending apparatus as the patient

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(*a*) Chirurg. Kupfert, No. 346.

(*b*) Ueber die Schwächung der Lehnen durch Einschneidung; in HUFELAND and HUMBY's Journ. der prak. Heilk., vol. vi. p. ..

can bear it. Objections, however, have been made to the operation, that in consequence of the often long-continued bent position of the leg, the joint surfaces in the knee are so much altered in form that they cannot retain their reacquired natural position, and consequently dislocation of the shin-bone backwards occurs (1). The operation is performed by passing a *phimosis*-knife between the hamstring and the bone, or between it and the skin, taking care to avoid the *peroneal* artery and posterior *tibial* nerve (2).

(1) Fergusson, of King's College, informs me, that in two or three instances he has seen dislocation at the knee occur after division of the hamstrings for contracted knee, and has been obliged to amputate the limb.

(2) Stanley (*a*) operated on a case of contracted knees two years after *paraplegia* consequent on sleeping in a damp bed. "Each knee-joint was immovably fixed in the state of extreme flexion; the ham-strings were contracted and rigid; and the cellular tissue around them had become indurated, and firmly agglutinated to the tendons, whereby their outline could not be distinctly traced. * * * To avoid all risk of injuring the popliteal or peroneal nerve, he deemed it prudent to divide the rigid hamstrings, and the surrounding indurated cellular tissue, by small subcutaneous incisions many times repeated in both limbs, applying after each operation the apparatus for extending the knee-joint." By this proceeding, after many months, the joints slowly straightened, and became movable; but, the action of the ankle-joints being impeded by the rigidity of the Achilles' tendons, Stanley divided these, and afterwards the extensor tendon of each great toe, as it was rigid, and kept the toes constantly raised. Warm baths and friction were employed for suppling the limbs, and, at the end of eighteen months, the case was perfectly cured.—J. F. S.]

C.—OF CURVATURES OF THE FEET.

1369. The feet may be curved in various ways; thus, they may be turned inwards *(Vari)* or outwards, *(Valgi,)* or the sole of the foot and the heel may be inclined so backwards and upwards, that the entire sole shall have the same direction as the leg, or the foot may be so drawn forwards and upwards towards the shin-bone, that the point of the heel alone touches the ground. The first kind of curvature is called *Club-foot;* the second, *Splay-foot;* the third, *Horse-foot;* and the fourth, *Heel* or *Hook-foot (Pied-bot calcairen* of Scoutetten.)

Duval (*b*) includes the various curvatures of the foot under the general name *strephopodie*, and distinguishes varus as *strephendopodie*, valgus as *strephexopodie*, horse-foot as *strephocatopodie*, its highest degree as *strephypopodie*, and heel-foot as *strephanopodie*.

a.—OF CLUB-FOOT.

(Varus, Lat.; *Klumpfuss, Knollfuss*, Germ.; *Pied-bot*, Fr.*)*

Sheldrake, Thomas, Observations on the Causes of Distortions of the Legs of Children. London, 1794.

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(*a*) London Medical Gazette, vol. xxxv. p. 98. 1844.

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1370. *Club-foot* is that deformity in which the foot is so twisted on its long axis, that its inner edge is raised, the outer turned downwards, and the sole of the foot with its back brought more or less vertical. The toes are strongly bent, the back of the foot more convex, the sole more concave, and the heel raised, and inclined inwards, so that it does not touch the ground. The whole foot is unnaturally turned inwards. Upon the back (instep) of the foot, a considerable prominence is formed by the head of the *astragalus;* the Achilles' tendon is much stretched. Walking is more or less interfered with; the patient cannot tread upon the sole of his foot, but only on the middle of its outer edge, and, often only on the outer part of the back of the foot, where commonly a large callosity or mucous bag is enlarged or newly formed. The patient is never able to bend his foot by muscular power; but, in making the attempt, he rather adducts the foot already inclined inwards.

1371. Club-foot has various degrees. When slight, the curved foot may be brought back to its natural position, and the prominence on its back then disappears; but the foot again treads in its unnatural posture when walking is attempted. In the higher degrees, the foot can never be at once brought to its natural position, and often can scarcely be moved in that direction. In these motions of the foot, the fibres of the *m. gastrocnemii* and *tibialis anticus*, and the plantar *aponeurosis*, which are always more or less stretched, oppose the straightening of the foot.

1372. This malformation, which has been noticed as hereditary, is either congenital, or occurs subsequently. In the former case, which is the most common, the club-foot arises as consequence of arrested development; of a continuing, excessive activity of the bending muscles of the foot, as has been often observed in a three months' *fœtus;* or as consequence of peculiar position of the foot during pregnancy, and therewith also deficient innervation depending on diseased activity of the brain, and nervous system. After birth club-foot may be developed by wounds, by palsy of muscles, by spasm or *neuralgia*, and if the foot have been kept a long while in a particular posture by an ulcer, or any other painful circumstance, by which shortening of certain muscles is produced. The disturbed antagonism of muscles (contraction of those attached to the sole, and to the inner edge, extension of those to the outer edge, and back of the foot) is the special cause of this malformation; all the changes which therewith occur in the ligaments and bones are merely secondary symptoms.

The shortened muscles are *m. tibialis anticus*, and *posticus*, *gastrocnemii*, *soleus*, and *plantaris*, the plantar *fascia*, *m. flexor longus digitorum pedis*, *abductor pollicis*, *transversalis pedis*, *flexor brevis minimi digiti*, *flexor longus*, and *brevis pollicis*. The lengthened muscles are *m. peroneus longus*, *tertius*, *brevis*, *extensor longus* and *brevis digitorum pedis*, *abductor minimi digiti*. All the ligaments on the plantar surface, and on the inside of the foot, are shortened, as, on the contrary, those on its back and outer edge are lengthened. The tarsal bones are herewith, according to the degree of curving, more or less removed from their mutual contact, without entirely leaving the sockets or hollows, in which they had been received. The navicular, the cuboid, the heel-bone, and *astragalus*, especially change their position, and are twisted on their small axis. If club-foot exist long, the bones are fixed in their unnatural position, and more or less changed in their form.

Opinions as to the cause of club-foot are very various. The notions of Paré and others, who held it to be the consequence of long sitting during pregnancy, with the legs twisted over each other, or from pressure of the feet in washing and carrying children, are merely to be mentioned. Duverney (*a*) fixed the cause of these curvatures in the muscles, and derived it from the unequal stretching of them and of the ligaments. Scarpa, as well as Brüchner and Naumberg, believed that vicious twisting of the foot first exists, and thereby is caused an approximation of the points of insertion of some muscles, and the distancing of others from their fixed points; consequently, a shortening of the former, and an elongation of the latter. Wantzel considers club-foot as great adduction, accompanied with violent extension, whence necessarily are the corresponding consequences; and Jörg holds it as a continued adduction, become habitual to the foot. Delpech (*b*) has of late withdrawn his previous opinion that the cause of club-foot is in the form of the bones, because the muscles do not oppose a contrary direction of the foot, which is especially distinct in those cases where the shortening is accompanied with atrophy, and with a sort of palsy. He considers the congenital, or accidental shortening of the muscles, as the peculiar cause of club-foot and, at the same time, has pointed out the retraction of the plantar *fascia*. Rudolphi, who has several times seen this deformity in the *fœtus* of from three to four months, derives it from arrest of the nervous influence, contrary to the opinion put forth by Camper and Glisson, that the club-foot arose from vicious position of the child in the womb, by which the foot was pressed on, and its development prevented; an opinion in which Cruvelhier (*c*) has participated, and Martin (*d*) has sought to ground in pressure of the womb from deficiency of the waters. Scoutetten holds the following as the causes of congenital and postgenital club-foot. 1. Unequal division of power between the extending and flexing muscles; 2. Vicious condition of the joint surfaces of the tarsal bones; 3. Vicious position of the *fœtus* in the womb; 4. Compression of the flexible joints by contraction of the womb; 5. Convulsions of the child in the womb; 6. Convulsions in early childhood; 7. Chronic inflammation of the muscles of the leg; 8. Vicious innervation, dependent on disease of the brain, or spinal marrow, without previous convulsions; 9. Contraction of the plantar *fascia*; 10. Contraction of the muscles, without discernible cause. Duval (*e*) assumes as causes of congenital club-foot, (as well as of the other curvatures,) vicious position of the foot in the womb, and disturbance of the functions of the brain and spinal marrow. Consecutive or accidental curvatures he derives from wounds, fractures, dislocations, bad holding of the foot, from inflammation, abscess, and so on. With all these causes, unequal activity of the muscles exists. Blasius (*f*) puts forth the congenital club-foot alone as the *true* one; in it the above-described symptoms are found. That occurring after birth, which usually is not so great, and is produced by wounds, ulceration, palsy of the muscles, dyscrasy, and neuralgy, is a natural extension of the foot, caused by too violent contraction of the muscles of the calf, in which the turning around the long axis of the limb follows only secondarily from walking. This he calls the *seeming* club-foot.

Club-foot is, according to Little, easily distinguishable from that deformity of the

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(*a*) Traité des Maladies des Os, vol. ii. c. 3.

(*b*) Orthomorpie, p. 117.

(*c*) Anatomie Pathologique du Corps Humain. Paris, 1828–30. Ib., liv. ii.

(*d*) Bulletin de l'Académie de Médecine de Paris. 15 Nov., 1836.

(*e*) Révue Médicale, Nov., 1838.

(*f*) Klinische Zeitschrift für Chirurgie und Augenheilkunde. pt. i. p. 60.

tarsus which is caused by rickets. The participation of the parents in the disease, the usual complication which accompanies rickets; above all, the curvature of the bones of the limbs, serve as sufficient diagnostic marks. The *pathognomonic* signs, retraction of the heel, stretching of the tendons of the muscles of the calf and the adductors, concavity of the sole of the foot, and the curvature of the inner edge of the foot are wanting.

On anatomical examination the bones appear in *varus* to be brought out of their position, without prejudice to their natural firmness, from muscular activity, and the weight of the body; in *false varus*, which arises from rickets, the bones are not only brought out of position by the weight of the body, but also compressed and misformed, in consequence of their softening.

[The following interesting case of club-foot was under my care some years ago, in which the cause was at first very doubtful, and led to several operations; but subsequently I think there could be little doubt that it was hysterical.

Case.—S. P., aged seventeen years, a stout, healthy girl, was admitted

April 9, 1837. She has been irregular for several months, and has had three fits, but of what kind cannot be ascertained. About a month ago she went to bed seemingly quite well, and with perfect use of her limbs; but, when she awoke in the morning, her right foot was immovably fixed, with the sole turned upwards and inwards, so that when put to the ground, the limb rested on the whole length of the outer margin of the foot. This was accompanied with great pain along the course of the *m. peronei.*

At the present time the foot is firmly fixed at right angle with the leg, and the sole faces directly inwards, the *m. tibialis anticus* is in strong action, and its tendon raising the skin in front of the ankle-joint. No other tendon or muscle is unnatural. Any attempt to restore the proper position of the foot causes great pain in the course of the contracted muscle.

In the course of the two following months, a moxa was thrice applied on the calf of the leg, with the hope of stimulating the antagonist muscles to action, but without benefit.

May 18. She was attacked with pain on the inner edge of the calf of the leg, followed by a little swelling, as if the *m. gastrocnemii* were in action at that point, and accompanied with slight tenderness. These subsided in the course of a few days, and her condition otherwise remained unchanged.

June 15. A stream of cold water was ordered to be poured on her leg, from a height of five or six feet, for a quarter of an hour every morning. This was persisted in for three weeks, occasionally followed by pain; but then given up, as there was an erysipelatous blush about the ankle, which, however, soon subsided.

July 10. A moxa was put in opposite the origin of the sciatic nerve.

July 14. Complains of pain on the outer side of the calf, but more severe than before and accompanied with swelling of the muscle; these have been coming on for the last three days, and the swelling is about the size of half a walnut, tender, but not firm though very distinct.

On the following day she was electrified in the whole length of the *m. peronei*, and from them across to the *m. tibialis anticus.* This was continued daily for a short time and she fancied she could move her great toe a little.

July 21. One or two electric shocks were also passed through the region of the womb, in hope to excite it to action; but, after repetition for two or three days, was given up as it produced great pain in the *pelvis*, without other effect.

Aug. 9. The electric shocks having blistered the front of her leg, sparks were ordered to be taken daily instead. About a fortnight or three weeks after, the anterior tibial muscle certainly had yielded, and she was able to get the sole of the foot flatter upon the ground, and walk a little better. This, however, lasted only a fortnight, and the foot then gradually reverted to its old position, if not worse. The electricity was therefore given up, and nothing more was done till

Oct. 21, when the tendon of the *m. tibialis anticus* was divided two inches above the ankle-joint, with a *phimosis*-knife, and snapped with a sharp report. Motion was immediately restored, and the sole could be placed on the ground, but returned to its old position when left alone, and she then suffered great pain in the instep, and up the front of the leg, which continued for three hours. It therefore was necessary to preserve the natural position, by applying a foot-board to the sole, on the sides of which the branches of a stirrup were attached, and from its crown a rod, with a screw for adjusting its length, was carried upon the front of the leg, and fixed by a circular bandage below the knee. This apparatus did not answer the purpose, and therefore, on the following day, I put Boyer's splint on the outside of the limb with a foot piece. This was continued for more than a week, but every day the foot was found returned to its old posture, and for the greater part of the time the pain in the leg continued. At the end of the week a back-splint was put behind the length of the limb, and the top of the long splint fastened to it, to prevent it turning forward, in which position it had been daily found. This at first seemed to do very well, but it failed, though carefully attended to in the same way for a fortnight.

Nov. 15. Still nearly as great inversion of the foot as at first, but it could be restored to its proper place by the hand as easily as at first, and when let go again became distorted. The peroneal muscles do not seem to have the least power. Flexion of the foot upon the leg is much restricted, and it seems probable that the Achilles' tendon will require division.

Wishing to try whether any advantage would be attained by her attempting to walk, an apparatus was applied on the outside of the leg, consisting of an iron rod, jointed at the ankle and keee, and extending half up the thigh, with some straps round the leg and thigh, and a foot-piece at right angle with its lower end, upon which the sole of the foot was firmly bound with a roller. She was directed to move about with this, and upon crutches. The sole bears well on the ground, but the great toe turns inwards, and she has pain along the back of the leg. This plan was persevered in for ten days, the bandages being adjusted as was found necessary.

Nov. 25. On consultation with Dr. Little he thought the *m. tibialis posticus* was at fault, and I therefore divided it with a *phimosis*-knife, from behind forwards—to wit, entering the knife between the tibial and long flexor muscles of the toes, about three inches above the ankle, and carrying the point down to the bone, cutting with it inwards. The inversion immediately subsided, and the foot recovered its natural position; a slip of plaster and a narrow roller were applied, but nothing more done.

In the evening she had pain along the inside of the shin-bone, which increased during the night, and subsided on the following morning, but came on again towards evening with severe burning, and a sensation of stretching along the front of the leg, but which entirely subsided next day.

Nov. 29. On visiting her this morning, the foot was again found a little turned in the old direction, which she herself had noticed when she first woke this morning. She complains of "a shrinking pain along the inside of the leg, very different from the stretching which she first felt on the night of the 26th; but which has now entirely ceased." The foot can be restored to its natural position without the least difficulty, but, when left alone, has still the disposition to turn in. The jointed iron rod and foot-piece were therefore reapplied, and answered well.

From this recurrence of the distortion, and the continued absence of the menstrual discharge, accompanied with headache and pain in the loins, it became questionable whether it might not really be an hysterical affection, of which indeed there had been a suspicion when she was first admitted. It was therefore determined that she should take *mist. ferri. comp.* ℥jss. *ter die*, which was continued till

Dec. 16 without any benefit. It was therefore left off, and five grains of ergot of rye three times a day, with a warm foot-bath every night, were ordered. Two days after, the headache and pains in the loin were much relieved, and had ceased entirely on

Dec. 23; but no change or improvement has occurred as to the menses, or the inversion. The medicine was suspended for three weeks.

Jan. 28, 1838. The ergot resumed for a week.

Feb. 7. The ergot again. Ordered for the same period.

Feb. 24. No alteration. The foot continues turned in, but there is no disposition of elevation of the heel. It was therefore determined to excite the action of the *m. peronei* by blistering along their whole length.

March 3. A second blister has been applied, but there is no improvement; indeed, the heel is more elevated. A third blister was then put on, and the stirrup readjusted to the foot and leg. On the following day the menstrual discharge appeared sparingly, the first time for thirteen months, and continued only a couple of days.

March 31. She took a dose of the ergot, and next day the menses appeared, and continued for three days; but no recovery of the foot followed, and she left the house in

April, with the sole still turned inwards and upwards.

I saw nothing of her for several months, till I accidentally met her; and, observing she was walking well with the sole of the foot to the ground, which she informed me had recovered itself, without any further treatment, a month or two after she had left the house, and that she was menstruating regularly.

From this account, I was led to believe that the contraction of the muscles, which had successively occurred, was hysterical, and that the operations I had performed were superfluous.

Varus sometimes occurs as consequence of palsy of the muscles of the leg during teething. I operated, in 1839, on a case of this kind in a girl, between eleven and twelve years old, in which the foot first dangled from the ankle; but, as she grew up, and began to walk, inversion commenced, and, when I first saw her, whilst standing upright, the foot rested on the whole *dorsum pedis*, except the great metatarsal bone, which faced outwards; the tuberosity of the heel-bone was raised about an inch from the ground, and its under surface faced inwards; before this bone nearly the whole sole faced directly upwards. When lifted from the ground, the foot nearly recovered the natural position; but there was still a little disposition to inversion, and the weight of the front of the foot pointed the toes. When the knee was straight, the foot could not be flexed at all on the leg; but, when the knee was much bent, the sole could be almost entirely applied to the ground. The gastrocnemial muscles were little developed, and the muscles generally did not control the foot. The ACHILLES' tendon was divided, and extension made; after five weeks, a steel rod, jointed at the angle and knee, and attached to a boot, was put on, soon after which she got up, and, in rather more than seven weeks, began to walk with the sole flat on the ground, with the assistance of a stick, which, in the following week, she threw aside of her own accord, and walked slowly without assistance. She would probably have improved more quickly, but that a slough formed on the skin of the tuberosity of the heel, in consequence of the foot-piece of the first-applied apparatus having pressed unduly. At the end of six months she walked very well, and the treatment had perfectly succeeded.

Shortly after, I had another case of the same kind in both feet of a child, three years old, in which the same proceeding was adopted with success, as the child walked upon the soles tolerably at the end of six months, whilst wearing boots with jointed steel leg-rods. But he could not do without these, as the paralytic muscles had not recovered, although galvanism had been employed.—J. F. S.]

1373. As to the *prognosis* of this ailment, all depends on its degree and complication. If there be simply disproportion between the muscles, if the twisted bones have neither their form changed, nor are fixed in their unnatural position by *anchylosis*, a favourable issue may be hoped for; and the more if the patient be young, far distant from manhood, have no accompanying dyscrasic disease, and the nutrition of the curved foot have not suffered much. The time in which the cure of this ailment may occur, is not determinable, and depends upon the mode of its treatment, in addition to its degree and duration. In adults who have walked long on their crooked feet, in which the bones are anchylosed, or considerably changed in form, their complete cure is impossible.

1374. The *treatment* of club-foot consists in the restoration of the natural antagonism of the muscles, and of the straight direction of the foot, which is effected either by lengthening the shortened muscles by means of gradual extension and mechanical contrivance, or by cutting through the tendons of the shortened muscles, and subsequently straightening the foot by mechanical means. The first (mechanical) mode of treatment is always tedious and difficult, especially in a greater degree and longer duration of club-foot, in which case frequently it is of no service. It is indicated in slighter degrees of club-foot, when the foot can, without much trouble, be brought straight, and a constant careful oversight of the patient is possible. The division of the tendons is in all cases the most fitting, when the first mode of treatment has been without benefit, or where the greater degree and duration of the curvature has led to the expectation of its being baffled, or, from external circumstances, a speedy termination of the cure is required.

1375. The treatment, by gradually lengthening the shortened muscles, is divided into the periods of *rightly directing*, of *steadying the foot*, and of *walking*.

In order to bring the foot gradually into the straight direction, it is recommended to use a warm bath, in which twice daily, the foot is to be immersed up to the knee, for about half an hour, and during this time attempts made to bring the foot into its natural position, holding it with one hand, so that the thumb lies upon the back, the forefinger on the inner edge, and the other fingers upon the sole of the foot, and with the other hand placed round the heel, by which the foot, and especially the heel, is turned outwards, the front of the foot raised, and its hind part depressed. These manipulations must be carried on slowly, and for some time. When the foot has been taken out of the bath, and properly dried, lard or goose-fat is to be rubbed on the inner and hinder part of the leg, and on the inner and *plantar* surface of the foot, and any spiritous fluid should be rubbed on the fore and outer part of the leg and foot. For the purpose of keeping the foot drawn towards its natural direction, a triangular piece of cloth is used, folded to the breadth of two fingers, and about three-quarters of an ell long; it should be placed beneath the calf, carried around both ankles, from without inwards, over the back, and over the middle of the inner edge of the foot, under the sole outwards, and, by proper drawing, it bends the foot outwards. This turn being repeated, the tip of the cloth is carried from the outer, obliquely upwards towards the upper edge of the foot, and both then connected by a packer's knot upon the back of the foot, are carried around the ankle, and tied together (BRÜCHNER's bandage.) This cloth must be applied once or twice a day; but, as it nevertheless is easily displaced, strips of sticking plaster may be applied on the same plan, much more efficiently, for the purpose of bringing the foot into place (*a*).

In children born with club-foot, we are restricted for the first two or three months, on account of the delicacy of their skin, to frequent daily manipulation, by which it must be attempted to bring the foot gradually to its place; and subsequently the mode of treatment proposed is to be employed. Success is frequent in these cases, on account of the slight degree of the evil and the yieldingness of all the parts. A club-footed patient who has already walked, must from the very onset of the cure be carefully restricted therefrom.

SCARPA has recommended a peculiar spring for gradually bending the foot outwards; it is applied on the outside of the foot, and fastened with two straps. Repeated experience has decided me on giving up this practice, and giving preference to the sticking plaster.

[As far as I have had opportunity of observing, little real benefit is derived beyond straightening the foot, whatever bandage or apparatus be used, before the child can be put on his feet, and the weight of his body counteract the unnatural contraction, or disposition to contract, of the gastrocnemial muscles. I therefore rarely do more than, as CHELIUS recommends, fix the foot with sticking plaster, and, perhaps, put on a light tin shoe, with a back, to render the bandage more firm, but with little expectation of flexing the foot.—J. F. S.]

1376. When the foot has been so far managed, that it can be brought with the hand to its proper place, it is best retained there by the so-called SCARPA's second machine (1), which is applied over the stocking and worn day and night. The patient may then be permitted, gradually and upon even ground, to stand and walk. After some time, when the foot retains of itself its natural position, the apparatus may be left off during the day, but still worn at night. It is best to let the patient wear a laced boot, which should lace to the toes and have a thin steel plate at its back.

(1) SCARPA's machine consists of a shoe, the front of which is made of a thin padded shoe sole, and the back part of a steel plate (a parabolic spring) which encloses the

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(*a*) GIESE. Salzb., Medic.-Chirur. Zeitung, 1814. vol. iv. p. 75.

whole heel. On the inner part of this parabolic spring is a padded strap, which is drawn over the back of the foot and fastened to a stud on its outside. A horizontal spring is continued from the outside of the parabolic one to the tip of the foot, around which it is fastened by a padded strap. At the hind end of this spring is a strap fastened to a stud on the inside of the parabolic one; and from the outside of the latter a moderately curved spring, with its concave surface towards the leg, ascends up to the region of the knee, and is connected with the parabolic spring by a rivet in form of a T. Two padded straps serve for fastening it to the leg above the ankle and below the knee, which, by means of pieces of tin and screws, can be variously attached to the vertical spring. SCARPA's machine is similar to that proposed by DELPECH (*a*). To it must be given merited praise and preference above all others (*b*) (2).

Besides those mentioned, a number of machines and apparatus have been proposed, of which mention can only be made. HIPPOCRATES' laced boot; the apparatus of PARÉ, HILDANUS, and HAAR; the machines of VENEL BRÜNNINGHAUSEN (*c*), of AUTENRIETH, of BLÖMER (*d*), of DELACROIX, and others.

[(2) SCARPA's shoe is a very good instrument when the *varus* is not great, but it will effect no benefit in a bad case; nor will any other; and division of the tendon, or tendons, will be requisite to produce a cure. I may mention, that where I have seen it used, the child walks on his heels, and in spite of the spring, the gait is that which is so well known as resulting from what is called *pigeon toe.*—J. F. S.]

1377. The subcutaneous division of the tendons for the more speedy restoration of the position of the foot especially applies to the ACHILLES' tendon, the tendon of the *m. tibialis anticus*, and the plantar *fascia.* The ACHILLES' tendon generally offers the greatest hindrance to the proper direction of the foot; its division alone is in many cases sufficient, or only in the after-treatment is the necessity for the division of the other tendons declared; often, however, on first examination the necessity for the simultaneous division of both is shown by the great stretching which the other tendons present. Besides those mentioned, I have, even in the most severe degree of club-foot, never found it necessary to divide any other, although the division of the tendons of the *m. tibialis posticus* and of the *m. flexor longus pollicis* have been considered necessary and performed by others; and STROMEYER, who has frequently cut through the tendon of the *m. tibialis posticus*, himself admits that from the result of his observations on the division of this tendon no decisive influence upon the restoration of the form and function of club-foot is to be ascribed to it.

1378. The division of the ACHILLES' tendon is performed most simply and effectually in the following manner. The patient is laid upon his belly, the leg held by one assistant and the foot pressed in its natural direction by another, so that the ACHILLES' tendon may be tightly strained and very prominent; the thumb and forefinger of the left hand are then to be placed on both sides of the tendon to fix it and the skin covering it, and then a narrow *slightly* convex and pointed bistoury (1), held flat, is to be thrust in at the inner side of the tendon and directly behind it, about two inches above the heel, beneath the skin, without penetrating it on the outer side, and then the edge of the knife being turned towards the tendon, cuts it through (whilst the flat of the thumb of the left hand placed upon the tendon presses it against the edge) with one or more strokes, without injuring the skin. At the moment of the complete division of the tendon a crack is heard, the two ends of the tendon separate more or less widely asunder, and the foot inclines in the same proportion to its natural position. As soon as the knife is withdrawn slight pressure

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(*a*) Above cited, pl. v. vi. vii. Orthomorphie, pl. xlii.

(*b*) MEINHAUSEN; in Gött. gel. Anzeig., 1799, p. 713; 1807, p. 2049; 1801, p. 1321.

(*c*) RICHTER's Chirurg. Bibliothek, vol. xv. p. 566. pl. i. f. 1, 2, 3.

(*d*) B. BRUNS, Dissert. de talipede varo. Berol., 1827.

should be made with the thumb against the little wound, to squeeze out the blood and to prevent the entrance of air; the wound is to be covered with some strips of sticking plaster and wadding, which are fastened with some turns of a lightly-applied roller. The patient is then to be carried to bed, and the foot placed in a suitable position.

Thilenius (*a*), Michaelis (*b*), and Sartorius (*c*) cut through the tendon simultaneously with the skin. Delpech thrust the blade of a bistoury behind the Achilles' tendon, so that on both sides a skin wound is produced about an inch long; a convex knife is then introduced, with the edge of which towards the tendon he divides it transversely, without wounding the skin above it. Stromeyer thrusts in a narrow curved fistula-knife about two inches above the heel, behind the Achilles' tendon, and out at the other side, and cuts through it in withdrawing the knife. Stoëss makes with a narrow double-edged bistoury, which he thrusts in flat behind the Achilles' tendon, a wound two and a half inches wide, without perforating the skin on the other side, draws the bistoury back, and introducing a button-ended one, slightly curved, and cutting on to a slight extent, with which he divides the tendon. Bouvier (*d*) makes a slight puncture in the skin with the point of a lancet a few lines before the tendon, where it is thinnest and strongest, and introduces through this puncture a straight narrow button-ended tenotome between the skin and tendon, and cuts through from before backwards. Guérin brings his narrow tenotome, slightly rounded in front, through a previously made small skin-wound beneath the tendon. Scoutetten stretches the skin with the fingers of the left hand, at the same time drawing it somewhat inwards, and thrusts in the tenotome at the inner side of the tendon, carrying it from behind forwards and from within outwards, without penetrating the skin on the opposite side; he now depresses the handle, draws the knife backwards and forwards, and the tendon is divided. Dieffenbach and others practise in the above-mentioned way.

[(1) I never use any other than a common *phimosis*-knife, which I pass flat *before* the tendon, till I can feel its point against, but without penetrating the skin on the outside of the leg; then turn the edge to the tendon, which being made tense by an assistant, and pressed against the knife with the left thumb, I cut through with the end of the knife as I withdraw it.—J. F. S.]

1379. When after from three to five days the little wound has closed, the return of the foot to its natural position is to be set about with a machine, which gradually effects the necessary apparent change of position. Stoëss' apparatus best answers this purpose. The return of the foot to its natural place ensues more quickly or more slowly according to the degree and duration of the curvature; all violence must be avoided, and by the *gradual* reinforced degree of extending the foot and proper soft pads, all painful pressure and excoriation are to be avoided. When the foot is brought to its natural position, Scarpa's apparatus may be applied and the patient allowed to walk. The movements of the foot are at first uncertain and stiff, but they improve by exercise, and in similar proportion does the atrophic condition of the muscles diminish, to which end rubbing at the same time with spirits may somewhat contribute.

Delpech's apparatus (*e*), Stromeyer's (*f*), Scoutetten's (*g*), and Pauli's (*h*) are also used for this purpose. Pauli, when after two or three days the little wound is healed, surrounds the foot with a mould of plaster of Paris, which he makes in a sort of jointed wooden boot and leaves to harden. If the proper position of the foot cannot be at once effected, he renews it frequently (1).

In not very great curvature, the foot often at once, after the division of the Achilles' tendon, can be restored to its natural position, and in these cases the extending machine may be at once applied. In most cases, however, this is impossible, or pain, inflam-

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(*a*) Medicinische und chirurgische Bemerkungen. Frankf., 1789. p. 335.

(*b*) Ueber die Schivachung der Sehne durch Einschneidung, als einem Mittel bei manchen Gliederverunstaltungen; in Hufeland's and Himly's Journal, vol. vi. Nov. 1831, p. 3.

(*c*) Siebold's Sammlung seltener und auserlesener chirurgischen Beobachtungen, vol. iii. p. 258.

(*d*) Bulletin de l'Académie de Médecine de Paris, December, 1836.

(*e*) Above cited, pl. ix.

(*f*) Pl. iii.

(*g*) Pl. vi.

(*h*) Above cited, fig. 1.

mation, and so on, are too easily excited by the extending force; it is therefore best to commence the setting straight first when the little wound has healed, (Stromeyer, Dieffenbach, Stoëss, myself, and others,) (2), and not immediately after the operation (Thilenius, Michaelis, Sartorius, Delpech, Bouvier, Pauli, Duval, Blasius.)

[(1) When I first began to operate on cases of *varus*, I had not any opportunity of either being acquainted with or seeing Stromeyer's apparatus, which I think is by far the best instrument for treating these cases I know of, and I used Boyer's splint for fractured thigh, with the shoe, which I first fastened on the foot, and then having fixed it upon the projecting bar, gradually, from day to day, drew down the upper end of the splint to the plane of the thigh-bone as the patient could bear it; for although when the shoe was firmly fixed, the length of the splint was so great, that it produced such powerful leverage as to overcome every resistance to placing the foot immediately in its proper position, yet I was afraid of attempting it at once, on account of the violence which would have been needed, and the pain the patient would have suffered; for even in the way I used it, the patient suffered considerably from the stress of the shoe-straps, and constantly sought to relieve himself, so that almost daily the foot was found more or less displaced, however well it had been arranged on the previous day, and therefore the progress of the cure retarded.

I therefore altered my plan, and instead of at once attempting to turn the sole down and flex the leg upon the foot, I first endeavoured to get the foot straight with the leg, leaving the toe pointed, and the heel raised, or in other words, to convert the club-foot into horse-foot, and afterwards gradually to flex the foot on the leg from day to day. The first part of the proceeding was effected by Boyer's splint and shoe, with the simple alteration of making the foot-bar, upon which the shoe was fixed, round instead of square, so that when the bar was entered into its socket, the sole of the foot was readily turned down without making any flexion upon the leg, the socket moving on the bar as the toe pointed, which it is always first disposed to do after the division of the Achilles' tendon. After a few days, when the patient had become accustomed to this new position, I began gradually to flex the foot on the leg, by slipping the foot-piece into the foot-piece of the stirrup apparatus for fractured knee-cap, the circular bandage of which was fixed above the knee, and then gradually shortened the screw rod as the patient could bear the stress upon the ball of the great toe, which was considerable. This answered the purpose, but it was a very clumsy contrivance, and I soon managed to contrive a more simple and efficacious instrument, which consisted of a pair of long narrow splints, like Boyer's splint, one for the outside, and the other for the inside of the leg and thigh, which were connected at bottom by the circular bar on which the foot-piece moved, and upon the leg and thigh, by three or four straps and buckles. For flexing the foot, a stud was placed on each edge of the foot-piece, near its toe end, upon each of which a leather strap fastened, by which the toe end of the foot-piece could be drawn up, and the foot flexed on the leg, to such extent as might be wished; and this being determined, the other end of each strap was fastened on a stud in the side of the corresponding splint upon the thigh.

This apparatus I have used very frequently and successfully, and with children it serves every purpose required, if the Surgeon be content to restore the straight position of the foot first, and afterwards to flex it. The instrument has the advantage of being easily made by a common carpenter and smith, and with little expense, even if a new one be made for every case treated. I do not presume to put in it competition with Stromeyer's excellent apparatus, which cannot always be obtained when required, is expensive, and needs some little practice for its proper employment. It is, however, a most capital instrument, and effects at the same time the flattening of the sole and the flexion of the foot with little more than a feeling of confinement to the patient, if it be properly adjusted.

(2) I fully agree with those who prefer leaving the limb at rest for a few days after dividing the tendon; as the patient then bears the extension with less pain. I first began by putting the limb in place at once after the operation, but finding it often necessary to slacken the bandages, I gave it up, and pursued the other practice with greater satisfaction.—J. F. S.]

1380. If there be present with club-foot, considerable bending of the toes and great concavity of the sole of the foot, in which case the plantar *fascia* is stretched like a cord in attempting to extend the foot, the division of that *fascia* is necessary (1). If the foot be strongly drawn inwards, and the curving of its outer edge be so considerable that the great toe and the inner edge of the foot are much contracted, then the tendons of the *m. tibialis anticus* and *extensor proprius pollicis* must be divided. In greater bending inwards of the foot, so that it can only with the greatest force be moved towards the horizontal axis of the shin-bone, the tendons of the *m. tibialis posticus* and *extensor proprius pollicis* must be cut through.

In dividing the plantar *fascia*, the heel and toes should be strongly drawn asunder by an assistant, by which the *fascia* is still more stretched and projected, the knife is to be introduced, flat, on the inner edge of the foot under the *fascia*, its edge should then be turned and the *fascia* cut through as it is withdrawn, without injuring the skin on the opposite side, which I have often done with ease. The tendon of the *m. tibialis anticus* may in this way be divided at the lower end of the shin-bone, where it projects very greatly beneath the skin; also the tendon of the *m. extensor pollicis proprius*, to the outer side of which the anterior tibial artery lies, and may be easily avoided. The division of the tendon of the *m. tibialis posticus* is made half an inch above the inner ankle; the nail of the left forefinger is to be placed over the posterior tibial artery, and the point of a curved knife carried to the bone, and forwards upon it, divides the tendon (2). A cut three-fourths of an inch long is made more conveniently along the course of the tendon above the inner ankle; the foot is then turned outwards, and the exposed tendon divided with the point of a knife (STROMEYER.) The tendon of the *m. flexor pollicis longus* is cut through near the inner edge of foot, where, when violently stretched, it projects between those of the *m. flexor pollicis brevis* and of the *m. adductor pollicis*, beneath the skin, without thrusting the knife out at the other side.

[(1) Shortening of the inner portion of the plantar *fascia*, producing great diminution in the length, with considerable elevation of the inside of the arch of the foot, in which case, the great toe generally stands almost upright, instead of resting horizontally on the ground, I have seen several times, independent of any disposition to club-foot. I have usually cured it without difficulty, by thrusting a *phimosis*-knife on the inside of the foot, opposite the base of the great metatarsal bone, between the skin and *fascia*, and dividing the latter in withdrawing the knife. No apparatus is requisite, but after three or four days, when the weight of the body can be borne, the patient is to be directed to walk about a little, so that the the newly-formed connecting matter is gradually lengthened, and the arch of the foot drops to its natural level; the great toe also at the same time recovers its place.

(2) The division of the tendon of the *m. tibialis posticus* is the only one which requires much anatomical knowledge or care, on account of the close neighbourhood of the posterior tibial artery, which I once divided in performing this operation on a child; it bled very smartly for a few minutes, and having enlarged the wound, I attempted to take it up, but the ends had retracted so much, that I could not succeed, and therefore thought best to bring the edges of the wound together and apply a compress. Union took place, and no hæmorrhage occurred. I have been told that such accidents are not very unfrequent, and that no inconvenience follows; but there can be no doubt it were better avoided.—J. F. S.]

1381. If the patient be kept quiet, ordinarily no important symptoms come on; I have not, at least, observed any in my own practice; and if they occur, they would depend rather on the patient's constitution than on the operation itself, if properly conducted. Should inflammation ensue, and if it be not dispersed by cold applications, the *pus* must be early evacuated, and by proper treatment the extension of the suppuration and exfoliation of the tendon prevented. If unfavourable symptoms occur after this operation, and if in some cases of old and very considerably curved club-foot the result of this operation be not perfect, or even not considerable, and which indeed cannot be previously ensured, yet they do not damage the value of this operation. Even in the earliest childhood it may be employed.

Blasius supposes that the operation, when applied to true club-foot, that is, to severe cases, where it alone can be preferred, effects little or nothing; that it rather only applies to spurious club-foot, and especially to slight cases. Club-foot is a complication of anomalies: and that the inversion is the most important point; but the operation is directed against only one anomaly, and not at once against the most important. Many groups of muscles participate in the vicious position; the operation is only directed against the muscles of the calf,—at most against the *m. tibialis anticus* or some one of the others. Atrophy of the leg is always present, and against it can the operation be of no use. This opinion is contradicted by what has been already said, and by the experience both of others and myself. Against Blasius's opinion of the propriety of amputation in such states of club-foot, compare Stromeyer (*a*).

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b.—OF SPLAY-FOOT.

(*Valgus*, Lat.; *Plattfuss*, Germ.; *Pied-plat*, Fr.)

Buchetmann, Inaug. Abh. über die Plattfuss. Erlangen, 1830; with plates.

Nevermann, Ueber den Plattfuss und seine Heilung; with a plate; in Hamburger Zeitschrift, vol. iv. part ii. 1837.

Stromeyer, above cited, p. 99.

Dieffenbach, above cited, p. 127.

1382. *Splay-foot*, the reverse of club-foot, is a frequently occurring deformity, in which there is not any actual twisting, but rather only such inclination of the foot outwards that the inner ankle projects very much and descends lower than natural, that beneath the outer ankle is a more or less deep depression, the natural arching of the back of the foot and the cavity of the sole and of the inner edge of the sole are lost, and the foot touches the ground at once with the whole sole, and is widest at the *tarsus*. Generally the foot is unusually cold, dusky red or bluish, as if frost-bitten, but, however, much disposed to sweat, so that it is always moist; the skin of the sole is soft, and without the usual hardness and callosities. In walking, splay-footed persons direct the knee inwards and the foot outwards, so that they mostly tread on the inside of the foot.

1383. The inconveniences in splay-foot are, speedy fatigue in walking, swelling of the foot around the ankles, and soreness of the soles of the feet, on which account persons so affected are not fit for military service in the infantry. From the continual straining of the feet, even chronic inflammation of the ligaments and synovial membranes arises, by which not merely pain but also serous exudation among the tarsal bones takes place. This requires rest, by which the transition to *caries* is prevented (Stromeyer.) It is remarkable that affections of all kinds arising on the feet or legs of splay-footed persons, especially inflammations and ulcers, are always remarkably stubborn.

Splay-foot must be distinguished from *Broad*-foot, which is simply an enlargement of the natural form of the foot dependent on the extension of the lateral ligaments, attached to the metatarsal bones, caused by their frequent use (*b*).

(*a*) Casper's Wochenschrift, 1836. Nos. 34, 35.

(*b*) The Circular to the Prussian military physicians, showing the difference of Broad and Splay-foot, in reference to the examination of recruits; in Rust's Magazin, vol. v. p. 1.

1384. Splay-foot is either congenital, and shows itself in different degrees directly after birth, as I have several times noticed, in which there is unyieldingness of the *m. peronei*, especially of the *m. peroneus longus*, and the ailment is certainly caused by the position of the child in the womb; or it is developed later, rarely in the female sex and in children under ten years. There is probably a congenital disposition in the position of the tarsal bones, or atony of the plantar *fascia* and tarsal ligaments, where first, at a subsequent period, and from straining in standing, walking, and so on, splay-foot is developed, and the heel-bone is so twisted inwards that its outer surface inclines more upwards, and the inner more downwards at the same time. The position of the other tarsal bones and their joints is little changed; the head of the *astragalus* and cuboid bone often project rather more inwards. In many families, especially among Jews, splay-foot is hereditary. Continual standing, especially with bare feet upon the damp ground, and much work influence its development. In the higher classes splay-foot very rarely occurs.

As to the causes of splay-foot, which have, however, only recently been attentively noticed, opinions are different. According to LISTON (*a*) the ailment arises from a thickening (*exostosis*) of the distal end of the first metatarsal-bone, in consequence of blows, rheumatism, gout, and scrofula, in opposition to which FRORIEP (*b*) correctly observes, that this is only an accidental complication of splay-foot. ROGNETTA (*c*) holds congenital splay-foot consequent on deficient development of the heel-bone, and the acquired, as consequence of relaxation of the ligaments of the tarsal bones. THUNE (*d*) lays the cause in a twisting round of the heel-bone, so that its outer surface is turned upwards, and its inner one somewhat inwards. The firm connexion between the heel-bone and *astragalus* by their unyielding ligamentous apparatus, causes a similar change in the position of the *astragalus*. If deformity be added, it is accompanied with subluxation between the articular surfaces of the head of the *astragalus* and the navicular bone, in which case the tuberosity of the latter sinks lower than the front part of the head of the former, which is itself sunken. The ligaments, especially the dorsal ligaments, between the *astragalus* and navicular bone, but still more, the plantar ligaments, and most of all, those between the two bones are very much stretched. The front fibres of the deltoid ligament, and *ligamentum fibulare tali anticum*, are also considerably stretched, as the shin-bone rests only on the hindermost part of the upper joint-surface of the *astragalus*, and thereby the navicular bone is removed more forwards and the splint bone more outwards from the navicular bone. STROMEYER places the cause of splay-foot in atony of the plantar *fascia* and of the tarsal ligaments. As these yield to pressure, the foot loses its arch, and contrariwise inclines outwards, because the action of the tibial muscles and of those of the calf, which properly press the outer edge of the foot and the ball of the great toe against the ground, in less strength of the ankle-joint, urge the shin-bone inward, which at the same time is accompanied with a driving forwards of the same bone. Atony of the leg is not to be considered as one of the causes in splay-foot; for in some degree of bad cases all the muscles are in such stretched condition that it cannot be ascribed to atony.

THUNE (*e*) distinguishes *primitive* and *secondary valgus*. The former is already fully developed at birth, and accompanied with a stretching of the muscles on the fore and outer part of the leg, which increases and becomes painful if it be attempted to put the foot straight; but the foot itself is not deformed. *Secondary valgus* occurs long after birth, after the patient has been accustomed to walk, and is constantly accompanied with a change in the form of the foot. THUNE has endeavoured to ground this distinction on the different appearances in the one or other form. In *secondary valgus* the axis of the foot is on its outer edge, concave externally. The inner ankle and the navicular bone form a projection, which, in walking, always more nearly approaches the sole, so that the *valgus* is in the highest degree *talipes*; the heel and the outer edge of the foot are away from the ground; the ACHILLES' tendon lies concealed behind the fold of skin, and is felt removed somewhat to the outer side; the heel is drawn upwards; the outer *malleolus* lies concealed in the ankle-joint; the leg, in consequence of wasting, is equally

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(*a*) Lancet, March, 1835.

(*b*) Chirurg. Kupfert. pl. 339.

(*c*) Archives générales de Médecine, 1834.

(*d*) NEVERMANN, above cited.

(*e*) NEVERMANN, above cited.

thick below and above, so that the knee appears as if deformed; the back of the foot (instep) is very much arched; and walking is performed generally not with bended knees. In splay-foot the axis of the foot is not changed, the ankle is very prominent, is lower than usual, and touches the ground; the whole sole of the foot touches the earth; below the outer ankle a cavity is formed, the depth of which depends on the degree of the deformity; the heel cannot be drawn up; the outer ankle is distinctly felt; the muscles of the calf are not greatly wasted; the back of the foot is not properly arched, but has at the *tarsus* an unnatural flattening and breadth; walking is generally performed with the knees bent. This distinction, however, depends on no actual difference, but is only consequent on simultaneous contraction of the muscles, that is, those of the calf, and on shortening of the ACHILLES' tendon; therefore, in such cases, the division of that tendon may be sufficient (*a*).

1385. In slighter degrees of splay-foot, and in young persons, the foot may be rubbed twice a-day with spirituous fluids, then wrapped up in a bandage, moistened with spirits of wine; cold baths are to be taken from time to time, or a laced leather stocking worn, which equally encloses the foot and leg, and a shoe, with a strong tin plate, which is convex from behind forwards to the metatarsal bones. According to DUPUYTREN, a shoe, with a flexible elastic sole, and raised in height from half to three-quarters of an inch; according to ROGNETTA, a raised shoe, together with swathing the foot in a bandage moistened with camphorated spirit, which is to be looked to and tightened twice a-day; according to STROMEYER, a boot, in the middle of which a piece of leather is fastened, confining the middle of the foot from below, upwards, and from within, outwards, then runs pointed, and is fastened by a slit in the upper leather at the outside of the foot, to a buckle. In weakly persons an internal strengthening treatment is at the same time proper. In old persons, and in a high degree of splay-foot, exutories are to be kept long to the sole of the foot, blisters upon its inner edge and on one part of the sole, and suppuration kept up by acrid ointment, for the protection of the foot-swathing, and a laced boot (STROMEYER.)

LISTON recommends a plaster of mercury and iodine to the swelling of the front end of the first metatarsal bone, and if this be insufficient, the head of the bone is to be removed with cutting forceps.

If the splay-foot be great and dependent on diseased contraction of the muscles, against which mechanical assistance is fruitless, HELD (*b*) proposes dividing the *m. peronei* and indeed the tendons of the *longus* and *medius*. The *peronei* contained in a common sheath are most prominent from four to six lines above the outer ankle; a double-edged bistoury is to be introduced flat beneath them from behind forwards, and the edge turned against them. The tendon of the *m. peroneus medius* has here still some muscular fibres. The tendons of these muscles are enclosed in proper sheaths from four to six lines under or before the ankle, but they lie so close together that they can be divided at the same time, as the knife is introduced between them and the heel-bone, from above downwards, and somewhat from before, backwards. The tendons of the *m. peroneus medius* may be divided also four or five lines from the base of the fifth metatarsal bone.

[In the cases of splay-foot which I have seen, the cause of the mischief appears to have been principally in the inner plantar, or calcaneo-navicular ligament; and it is generally accompanied with tenderness in this neighbourhood. I have usually directed repeated leeching till all tenderness had subsided, and perfect rest; but the relief has only been temporary.—J. F. S.]

(*a*) STROMEYER's case, above cited, p. 95.

(*b*) Above cited, p. 63.

c.—OF HORSE-FOOT.

(*Pes equinus,* Lat.; *Pferdefuss, Spitzfuss,* Germ.; *Pied équin,* Fr.)

JÖRG, Ueber die Verkrummungen, p. 77.

ZIMMERMAN, Der Klumpfuss und Pferdefuss. Leipzig, 1830.

DIEFFENBACH, BONNET, and PHILLIPS, above cited.

1386. *Horse-foot* is that malformation in which the whole splay-foot has one and the same direction with the leg; the heel is considerably drawn up, so that in walking the patient only treads with his toes, and especially with the ball of the great toe. The ACHILLES' tendon is very tense, the foot at the same time so arched that the convexity of the back and the concavity of the sole are increased. In the greatest degree so complete a turning about of the foot may be produced, that the tip of the foot is turned backwards, and the patient walks entirely on the instep (*a*).

1387. The cause of this ailment lies in an unnatural contraction of the muscles of the calf; subsequently also the *m. plantaris* and plantar *fascia*, the *m. tibialis posticus* and *peroneus longus* shorten, and the curvature is increased. In a very high degree of this ailment the joint surfaces of the *astragalus* are so far pushed forward, that they are nearly out of contact with the shin-bone, which rests almost entirely upon the back part of the heel-bone; however, it is frequently observed that in long continued and severe horse-foot, the tarsal joints are not particularly changed, but that there is a considerable removal of the front ends of the metatarsal bones from their connexion with the toes, inasmuch as they bear the chief weight in walking, in consequence of the toes being so much turned upwards.

Horse-foot is congenital or acquired; the latter is most common, because, if at the time when the ACHILLES' tendon is shortened the ankle-joint have not yet attained sufficient firmness, partly from the deficient development of the ligaments, partly from that of the ankles, and especially of the inner, club-foot is quickly produced by the simultaneous shortening of the *m. tibialis anticus* and *posticus.* Some inclination of the foot inwards is, however, frequently observed in horse-foot. Diseased change in the tarsal bones may also give rise to similar displacement.

1388. In reference to the causes, all that has been said in general, and on club-foot, applies here (1).

The *treatment* consists in the employment of baths, relaxing rubbings of the contracted muscles of the calf and their tendons, in manipulations, for the purpose of bringing down the heel and raising the front of the foot, which position must be maintained by the apparatus of JÖRG (*b*), STROMEYER, STOESS, and others. In a great degree and long continuance of horse-foot, no perfect cure is effected by this treatment, even though it be long persisted in; and the only division of the ACHILLES' tendon and the subsequent application of proper apparatus, as in club-foot, in a short time can restore the straight position of the foot. If the back of the foot (instep) be very much arched and the plantar *fascia* stretched like a cord, its division is mostly necessary. STROMEYER also cut through, in some cases, the tendons of the *m. flexor longus* and *extensor pollicis*, on account of a permanent improper position of the great toe.

(*a*) STOLZ, Mémoire sur une variété particulière du Pied-bot; in the Journal de la Société des Sciences de Basklim. Strasbourg, 1826, vol. iii. p. 458.

(*b*) Above cited, pl. vi.

Jörg's apparatus consists of a shoe like that of Scarpa's for club-foot; on the outer side of which an iron rod ascends to the knee and is fastened round the leg with a strap. At the lower part of this rod is a spring furnished with a stop-wheel, to which an iron rod is attached, which runs forwards along the foot. A strap carried round the front of the foot is affixed to the end of this rod, by which the foot is always drawn up (2).

[(1) Among the causes which produce permanent contraction of the gastrocnemial muscles and consequent horse-foot, may be enumerated ulceration, of which I had a good case in 1837, in a strumous girl, whose heel was raised four inches from the ground, the muscles being much shrunk in the calf, and the scar of the skin closely connected with them. The motions of both knee and ankle being perfectly free when the knee was bent, I divided the Achilles' tendon, and she was cured completely.

I had also, in the same year, a case of horse-foot under my care, which followed a palsy of the left arm and leg during teething, first at ten months, and next at two years of age, from which, however, when three years old, the patient had recovered so far as to walk about with the aid of a stick or crutch; and when about sixteen, he was able sometimes to walk even without a stick. Towards the end of the following year the heel began to leave the ground, and slowly rose still higher till he was twenty years old, when it was at least four inches from the ground, and had so continued when I saw him a twelvemonth after, (*Sept.* 1837,) the *tarsus* and *metatarsus* being then on the same plane as the front of the leg, and the foot resting only on the ball of the great toe. The foot was livid and pappy, and when lifted off the ground, dangled at the ankle-joint, both flexor and extensor muscles appearing to be paralysed. Although, under these circumstances, relief from division of the Achilles' tendon seemed to be very doubtful, I thought it worth while performing the operation, so that the sole might be brought to the ground, and then that attempts might be made to excite the muscles on the front of the leg to action. The tendon was therefore divided in the usual manner on *Sept.* 30, which brought the sole again flat, and its position was preserved by the stirrup and rod attached to a circular knee-strap, and the foot was gradually more flexed by shortening the rod as he could bear it. After wearing this apparatus six weeks, the foot, on its removal, was found still to drop, but not to the same extent. He was directed to try to move about on crutches, and to throw some of the weight of his body upon it; but the attempt produced severe pain in the muscles of the inside of the leg, which lasted a few hours, and then subsided. On the following day the muscles in the anterior tibial region were electrified for about a quarter of an hour. The foot however still dropping, the stirrup was reapplied; and five days after he was able to bear upon the foot, wearing the stirrup. without pain. About a month after he left the house, the sole of the foot was then flat on the ground, and the foot itself at right angle with the leg; but the muscles in the anterior tibial region were still wanting in tone. I have seen him several times since; the operation has succeeded so far as recovery of the position of the foot is concerned, but the muscles have not regained their power, and he is obliged to walk with a stick or crutches. The result of this case, as well also as of those *vari* already mentioned as following palsy from teething, led me in two or three instances to try the effect of dividing the Achilles' tendon where horse-foot was just beginning in children so paralysed, but no benefit was gained.

(2) The apparatus I have described for the treatment of club-foot, (*par.* 1379, *note*,) or even the fractured *patella* stirrup, will answer very well for drawing and fixing up the foot in a proper position. Indeed, this distortion of the foot is the most easy of treatment, and might be managed by a careful person merely with a shoe having tapes or straps fixed to its front, and fastened above on either side of a circular bandage above the knee.—J. F. S.]

d.—OF HOOK-FOOT.

(*Talus*, Lat.; *Hakenfuss*, Germ.; *Pied-bot calcarien*, Fr.)

1389. *Hook* or *Heel-foot* consists in the tip of the foot being directed upwards and its back towards the front of the shin-bone, so that the foot forms an acute angle with the leg, often even rests on the shin-bone, and in stepping, the heel only touches the ground. This deformity is always congenital, and manifestly consequent on the position of the *fœtus* in the womb. Often immediately after birth, when the foot is very much drawn up, even if, as I have frequently noticed, it lie upon the shin-bone, it may be brought, by slight force, into its proper place. The contracted muscles are the *m. tibialis anticus*, *extensor proprius pollicis*, and frequently the *m. extensor communis digitorum pedis*, the tendons of which form cord-like projections beneath the skin when the foot is properly placed. The joint connexion between the heel and cuboid bone, and the *astragalus* and navicular bone appear to suffer most; but the cuneiform bones are also drawn back and their joint-surfaces separated from each other in the sole of the foot. The point of the foot is also at the same time often turned outwards if the *m. extensor communis* act violently.

1390. In all the cases which I have hitherto seen soon after birth, it was easy to bring the foot straight, and by means of a curved splint, fastened with a bandage on the front of the leg and back of the foot, to keep it so, and in a short time to effect a cure. If the ailment be permanent and the contracting muscles opposed, this treatment, or the application of a suitable splint, in which case a more considerable atrophy of the leg shows itself than in other curvatures, the division of the stretched tendons, where they project most considerably under the skin, is more certainly efficient.

[Of this disease in an incipient state, I saw the following example under my late colleague Tyrrell, originating in accident and accompanied with severe and constant pain.

Case.—E. G., a tall bony spare widow of forty-six years was admitted

Oct. 24, 1835. A twelve month since she had thrown down a table, the edge of which struck her right foot across the heads of the metatarsal bones, and caused violent pain and swelling. Leeches and poultices were used without relief of the pain, and six weeks after the accident all the toes began to stand upright, which disposition increased; and when she left her bed a fortnight after, she was unable to put the whole sole to the ground, and could walk only on the heel, as she suffered acute pain along the middle of the sole, with pain in the instep, as if a cord were stretched over it, and shooting pain up the front of the leg as high as the knee. For the last six months the pain has been so severe that she has not been able to put her foot to the ground, but has walked on crutches; and once came into the hospital with the purpose of undergoing amputation, which however the Surgeon who attended her did not think justifiable. At present the foot is fixed at right angle with the leg, and all the toes raised at nearly right angles with the instep; all the tendons of the muscles in the tibial region have started and are very tight. She has great tenderness on the inside of her sole and heel, and across the under surface of the heads of the metatarsal bones, but no pain on the outer edge of the sole. There is great pain in the great toe, but not in the others. Pressure along the course of the anterior and posterior tibial and outer cutaneous nerves, to within a hand's breadth of the tubercle of the shin-bone, causes great pain which shoots up into the knee.

As it was thought that these symptoms were produced by the injury which the branches of the anterior tibial nerve had received at the time of the accident, and that she was probably in a condition similar to that of a horse with lame foot, for which Sewell of the Royal London Veterinary College had some years since cut out successfully a portion of the nerve going to the foot, by which its sensibility had been destroyed, and the foot again rendered fit for work, it was determined to perform a similar operation, and accordingly, on

Nov. 6, a cut was made about a hand's breadth above the ankle joint between the *m. tibialis anticus* and *m. extensor proprius pollicis*, and the nerve being found and carefully separated, an inch of it was removed. She suffered extremely whilst the nerve was being disturbed, but after its division the pain ceased, and the instep felt numb. The edges of the wound were brought together with plaster. She passed a good night, and on the following day was entirely free from pain, except slight pain in the great toe. On the third day, the toes had partially dropped towards their natural position, and on the following day were still straighter, and the great toe was numb. As there was a slight erysipelatous blush about the wound, the dressings were removed and a poultice applied. On the fifth day, a smart arterial bleeding, said to be to the amount of twelve ounces, followed the removal of the poultice, but stopped by pressure for ten minutes, and afterwards a compress of lint was bound on the wound. A slight oozing, however, continued, and on the following evening, bleeding recurred, and a similar quantity of blood was lost; it was temporarily restrained by pressure and the wound having been cleared of blood, an aneurysm-needle was passed beneath the anterior tibial artery, which was then tied with a single ligature.

Unfortunately after this time my notes fail, and I cannot get any satisfactory information, except that the woman did not undergo any second operation, and that she left the house four months after still upon crutches, but under what circumstances I cannot ascertain.—J. F. S.]

II.—OF CURVATURES OF THE UPPER LIMBS.

[These curvatures, excepting the fingers, are much less frequent than those of the lower limbs.

A.—OF CURVATURES OF THE SHOULDER.

These are of very rare occurrence, the weight of the arm constantly preserving its position close to the side, and antagonising any of the larger muscles by the contraction of which, alteration of its ordinary situation could be effected. In the contraction of the shoulder the arm is therefore pinned to the side, and the treatment consists merely in the application of blisters, or other irritating remedies for the purpose of inducing absorption of the interstitial deposit originating in rheumatic, or other inflammation of the soft parts about the joint; and the cautious use of extending apparatus, or passive motion, as the case may be.

The division of the tendons, as performed by Dieffenbach for the replacement of a long unreduced dislocation at the shoulder-joint, might certainly be applied to cases of contracted shoulder, but I should think little advantage could be hoped from it.

B.—OF CURVATURES OF THE ELBOW.

Curvatures at this joint, although very commonly resulting from *anchylosis*, or inflammatory deposit in the soft parts about the joints, are, in rare instances, consequent on contraction of the *m. biceps flexor cubiti*, and *m. brachialis anticus.* If arising from the former muscle, any attempt at extending the arm throws its tendon up, as it passes over the front of the elbow-joint, in form of a cord; by which the nature of the ailment is distinctly indicated.

If rubbing and passive motion, and the extending apparatus be unavailing, it will be necessary to divide the tendon of the *m. biceps* beneath the skin in the same way as the Achilles' tendon is divided, and afterwards to apply either a simple splint on the front of the whole lengthe of te arm, and with a bandage to straighten it gradually, as the patient can bear it, or to make use of the extending apparatus.—J. F. S.]

C.—OF CURVATURES OF THE HAND.

1391. Curvatures of the hand are more rare than those of the foot, and mostly depend on unnatural activity of the muscles. There is either permanent bending of the wrist-joint, with simultaneous pronation or supination, or permanent straightening, or the fingers are permanently bent.

a.—OF PERMANENT BENDING OF THE HAND.

1392. In *permanent Bending*, the hand forms with the fore-arm a more or less right angle, and is at the same time in a state of increased pronation and adduction, or of increased supination. In both cases the fingers are strongly bent. The bones and ligaments of the *carpus* are separated from each other and outspread behind, but in front (volar surface) are contracted, and form a depression. The hand and fore-arm are more or less atrophic.

LODE (*a*) distinguishes these two kinds of curvature of the hand, *Talipomanus flexor pronata seu Talipomanus vara* and *Talipomanus flexor supinata seu Talipomanus valga.* All the muscles which bend the whole hand and fingers, and increase the concavity of the hand, in the one case, the pronators, and in the other, the supinators, are contracted at once.

1393. This curvature of the hand may be congenital or acquired. As to its causes, all that has been said upon club-foot applies. I have noticed curvature of the hand as a congenital deformity, once accompanying club-foot and once with horse-foot on the same side. The treatment must be conducted entirely according to the rules laid down for club-foot.

A proper apparatus for straightening the hand is found in LODE, fig. 3.

b.—OF PERMANENT STRAIGHTENING OF THE HAND.

1394. *Permanent Stretching of the Hand*, in which its back is retracted, in a greater or less degree, towards the fore-arm, and is at the same time in a state of increased abduction or adduction, occurs rarely; and in reference to its ætiology and treatment, all that has been previously said applies.

LODE calls this curvature *Talipomanus extensa.* All the extending muscles of the hand and fingers, as well also sometimes those muscles which flatten the hand, sometimes the adductors and abductors, are contracted.

c.—OF PERMANENT BENDING OF THE FINGER.

DUPUYTREN, Retraction permanente des Doigts ; Leçons Orales de Clinique Chirurgicale, vol. i. pt. i. p. 117.

1395. A *permanent Bending of one or more Fingers* may depend on various causes, namely, on diseased changes of the phalanges, on division of the tendons or palsy of the extensors, on a contracting scar in the palm, on destruction of the tendons and sheaths, or contraction of the bending muscles of the hand, and contraction and unyieldingness of the palmar *fascia.* The *diagnosis* of these various causes is really unattended with any difficulty, and depends on the kind of origin, or the perhaps existing scar, or the possibility of moving some of the finger-joints, or on violently straightening the finger and so on. In this respect the curvature of the finger is most important, as consequent on contraction of the palmar *fascia*, because, with definite *diagnosis*, the cure may be more surely effected.

1396. The curvature consequent on contraction of the palmar *fascia* shows itself especially at the ring-finger, mostly in persons who are subject to hard labour, as resulting from inflammatory affection. After violent exertion of the hand, pain frequently comes on, which, however, soon subsides. The fingers are gradually straightened with difficulty, and the ring-finger

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(*a*) Above cited.

begins to curve into the palm, at the onset only the first joint bends, but the others follow its movements. In proportion as the ailment proceeds the ring-finger bends still more. At this period no knotty swelling is yet felt on the palmar surface of the ring-finger; its last two joints are straight and movable. The first joint is bent at a more or less right angle, it is movable in its connexion with the *metacarpus*, but the greatest violence cannot straighten it. If the ring-finger be considerably bent, the skin in the palm presents a fold in the direction of the concavity, towards the ring-finger, and the convexity towards the wrist. If the palmar surface of this finger be felt, a stretched cord is found, the point of which is directed towards the first joint, and which may be followed to the upper part of the palm. If the finger be bent, this disappears; but, if its straightening be attempted, the tendon of the *m. palmaris longus* is brought into motion, which extends to the upper part of the palmar *fascia*, and the cord is more tightly stretched.

According to Goyraud (*a*) the retraction of the tendinous cords depends on new formations, which pass from the *fascia* to the sheathof the tendon, from it to the lateral parts of the phalanges, and even from one phalanx to another. These bridges are, however, merely growths of the bridges existing in the natural state. Sanson (*b*) also believes that this is the usual cause, and the contraction of the palmar *fascia* only the exception.

If the bending of the finger depend on contraction of the bending muscles, a thick cord is felt, in attempting to straighten it, under the *fascia;* the *m. palmaris* remains immovable, but the bending muscles on the fore-arm are stretched. In a scar, with the muscles attached to it, stretching movements cause pain in the same part; if the hand be bent towards the fore-arm, then the patient can straighten his finger. In palsy, or in division of the tendons of the straightening muscles, the finger is kept permanently shut into the hand, but it may be straightened with a little force, no tight cord is felt, and all the joints are free. In diseased changes in the joints, the finger is more or less bent; the anchylosed phalanges are immovable; but the others can be moved, and no tight cord is felt in the palm. Many occupations give rise to deformity of the joints of the phalanges without *anchylosis*, but with permanent bending; thus is the little finger in knitters and seamstresses; so the ring-finger, and often several fingers of the right hand, in tailors; and in lace-makers the four last fingers of both hands are curved and so on, as consequence of habit; no cord-like stretching is, however, noticed in the hand, and the finger may still be somewhat straightened. Scars may be easily distinguished by their tension in attempting to straighten the finger.

1397. That the cause of this crooking of the finger is an excessive tension of the palmar *fascia*, which has arisen from pressure, and bruising in hard handiwork, Dupuytren has proved by careful observation, and by the successful division of this *aponeurosis*. Rubbing, bathing, mechanical apparatus, and the like, have usually no result, or only transient benefit. The latter I noticed in a considerable curvature of the ring-finger from this cause, in which, by continued use of gray mercurial ointment, and animal baths, the proper position and mobility were restored; but shortly after these remedies were given up, the finger again became as strongly crooked as formerly. The division of the palmar *aponeurosis* is most effectual. A transverse cut is made through the skin opposite to the junction of the first phalanx with the metacarpal bone, and then the stretched *aponeurosis* divided in the same direction. If the finger cannot then be straightened, a transverse cut must be made at the joint of the first and second phalanx, or in the middle of the first phalanx. If all the fingers be curved, a transverse cut must be made an inch and a quarter below the former one in the palm of the hand, and the *aponeurosis* divided.

(*a*) Schmidt's Jahrbücher, 1835. p. 248.

(*b*) Gazette Médicale, 1835. 1. 8 August.

The wound is to be covered with lint, and upon the back of the hand a flat piece of wood attached; on the front part, which has divisions corresponding to the fingers, the latter must be kept in the straight position, by means of nooses, till the scars are completely formed. If the palmar *aponeurosis* be narrow and stretched like a cord, it is best to determine on its subcutaneous division (*a*).

Goyraud does not divide the skin transversely as Dupuytren does, because, in straightening the finger, the cut in the skin gapes too much; but he cuts through it longitudinally, and through the bridge transversely.

1398. If the cause of the finger crooking be a scar, it must be treated according to rules to be hereafter mentioned. In contraction of the bending muscles, relaxing rubbings must be used on the side of flexion, and irritating rubbing, blisters, and so on, upon the side of extension, and also a corresponding mechanical apparatus. Crooked fingers, from destruction of tendons, or organic changes of the joint-surfaces, and the like, are incurable.

Tenotomy has been variously employed in contraction of the bending tendons and muscles, by which the finger has been perfectly straightened, but the movements of bending were for ever lost: the division may be performed on the phalanges or in the palm.

1399. As to the other curvatures, which are seated in the bones themselves, of the extremities, or in their joints, as for example the bending of the fore- against the upper-arm, or of the leg against the thigh, the bowing of the bones of the leg, the inward or outward turning of the knee-joint, and so on, what has been already observed generally, and the circumstances mentioned in the several kinds of curvature, applies to them. Their *treatment* must also be by internal and external remedies, as well as by the construction of suitable apparatus, which must always act by spring-power, and, if these be useless, and the cause be in the shortening of the muscles, if their tendons be accessible, the division of the stretched tendons and *aponeuroses* are easily effected. In such cases, the *m. pectineus* and *sartorius*, the tendons of the *m. biceps femoris*, *semitendinosus*, *semimembranosus* and *gracilis*, the *fascia lata* in the region of the intermuscular *aponeurosis* and the *m. biceps brachii* have been cut through.

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(*a*) B. Cooper; in A. Cooper's Treatise on Dislocations and Fractures. London. Edition, 1842. p. 511.

(*b*) Bonnet, above cited, p. 595.

(*c*) Doubovitzki, P., Mémoire sur la Section sous-cutanée des Muscles pronateurs–fléchisseurs de la Main et des Doigts. Paris, 1841.

IV.—SOLUTION OF CONTINUITY FROM UNNATURAL EXTENSION.

A —IN THE ARTERIES.

Of Aneurysms.

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1400. Every swelling produced by partial expansion of the cavity of an artery, or, after previous division of its coats, by effusion of blood into the surrounding cellular tissue, is called an *Aneurysm* (*Aneurysma*, Lat.; *Pulsadergeschwulst*, Germ.; *Anévrisme*, Fr.) In the former case it is named a true, (*Aneurysma verum*,) and in the latter a *false* or *spurious Aneurysm* (*Aneurysma spurium.*) Some writers have also mentioned a *mixed Aneurysm*, (*Aneurysma mixtum*,) where either after the external arterial coat is divided, the internal expands, or the contrary (*a*). This designation, however, is also used for the case when a true aneurysm bursts, and the blood is effused into the cellular tissue (*b*). The mixed aneurysm, taken in the former sense, does not exist. Breschet (*c*) has, however, by close examination, determined that the middle coat of the artery is torn, and a sac-like expansion produced by the protrusion of the inner coat through the opening in the middle, and by the expansion of the external coat. A combined division and enlargement of an artery and vein is called a *Varicose Aneurysm*, or *Aneurismal Varix* (*Aneurisma varicosum seu venosum*, or *Varix aneurysmaticus.*) If the expansion affect severa branches coming from different trunks, and anastomosing branches and their arches, with or without partial lateral enlargement of their walls such are distinguished as *Branching Aneurysm*, or *Aneurysm by anastomosis* (*Aneurysma anastomosium seu anastomoticum*, von Walther *A. spongiosum seu cirsoideum*, Breschet; *Varix arteriosus*, *A. pe anastomosin.*)

(*a*) Hunter, William, in Medical Observations and Inquiries, vol. i. p. 338.

(*b*) Monro, A., in Essays and Observations of Edinburgh, vol. ii. p. 238.

(*c*) Mémoire Chirurgicale sur différentes espèc d'Anévrysmes. Paris, 1824. 4to., with six plates.

[The writings of the ancient physicians show their acquaintance with aneurysm, which they described as of two kinds; one, the consequence of a wound in bleeding from the vein in the arm or spurious aneurysm, which would seem to have been of not unfrequent occurrence, as they are best informed about it; and the other by dilatation of the artery without injury, or true aneurysm. I have selected passages from Galen, Ætius, and Paul of Ægina, which are the foundation of the opinions long and subsequently held by writers on this subject.

Galen (*a*) says:—"When an artery is expanded, the disease is called an aneurysm. This happens when, the vessel being wounded, the adjoining skin cicatrizes, but the wound still remains in the artery, which neither unites nor heals, nor is filled up with flesh. Such diseases are known by the pulsation of the arteries, but when pressed, all the swelling disappears, the substance producing it returning into the artery, and which I have elsewhere shown consists of thin and yellow blood mixed with thin and much spirit. Forthwith is this blood hotter than that in the veins, and when the aneurysm is wounded, it darts forth and can with difficulty be stopped. But in *œdema* the substance yields to the pressure of the finger, and the ,limb pits, but there is no pulsation in this disease, and the colour is whiter, and the *œdema* is much more spread and greater than in aneurysm, except when a *thrombus* having arisen from it, produces gangrene." In another place (*b*) Galen says:—"Aneurysm is the dilatation of a vein, or the dispersion of the spirituous matter by its bursting beneath the flesh."

Ætius (*c*) describes the signs of aneurysm as "a tumour of small or large size, of one colour, free from pain, soft to the touch, and having a spongy looseness. It yields so to pressure of the fingers as to seem almost to disappear, but on the removal of the fingers it very quickly returns, which is especially observed in aneurysm and the rest that occur without a wound. But when there has been a previous wound of the artery, and the skin uniting, there is also accompanying dilatation of the vessels, the tumour is not equally soft, for the blood being more copious than the spirits, collects in clots and swells out the tumour."

Paul, of Ægina (*d*), proceeds farther, and distinguishes spontaneous aneurysm from that produced by accident. After having quoted Galen's definition and symptoms, he says:—"But I distinguish the one from the other thus: those which arise from a dilated artery are more bulky and deeply situated, and on examination with the fingers a sort of noise is heard; but no noise is heard in those caused by rupture, which are more round and arise superficially. He advises different treatment for the two forms of disease, as will be presently mentioned.

John Hunter defines aneurysm as "the dilatation of the coats of an artery, arising probably either from disease or accident, producing weakness, which becomes the remote cause, while the force of the circulation is the immediate cause. It probably may also arise, however, from a disproportion in the blood's motion, and then the disproportion between the force of the circulation and strength of the artery is both the remote and the immediate cause; but this is probably only in the larger arteries, where the force is greatest." (pp. 543, 44.)]

1401. In true aneurysm the walls of the artery are either expanded only at a small part of their course, (*Aneurysma verum circumscriptum*,) or the expansion affects a larger extent, and is gradually lost (*Aneurysma verum diffusum.*) False aneurysm is also divided into the *circumscribed* or *consequent*, (*Aneurysma spurium circumscriptum seu consecutivum*,) and the *diffused* or *original* (*Aneurysma spurium diffusum seu primitivum.*) In the former case the blood is effused under the cellular tissue of the artery, and outstretches it into a sac; in the latter, all the coats of the artery are divided, and the blood is poured forth into the interspaces of the whole limb (*par.* 278.)

Breschet distinguishes four principal kinds of true aneurysm according to the different form of the expansion of the arterial canal. 1. The *true sac-shaped aneurysm*, in which the artery exhibits at one part of its tube a fulness like a little sac,

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(*a*) Περι τῶν παρὰφυσιν Ογκων Βεβλιον, chap. xi. vol. vii. p. 725. Kuhn's Edition. 8vo.

(*b*) Ορϙι Ιατρικοι, par. ccclxxviii. vol. xix. p. 441. Kuhn's Edit.

(*c*) Τετραβιβλον, Discourse xv. chap. 10. I have been obliged to use the Latin Translation by Janus Cornarius, Basileæ, MDXLII. fol., not being able to put hand on a Greek copy.—J. F. S.

(*d*) Βιβλια επτα, book vi. chap. xxxvii. p. 188. Basileæ, MDXXXVIII. fol.

originating in the expansion of all the coats of the arteries. 2. The *spindle-shaped aneurysm*, in which all the coats of the whole tube of the artery are expanded, but narrow above and below, like a spindle. 3. The *true cylindrical aneurysm*, in which the canal of an artery is, for a greater or less distance, more or less regularly expanded. 4. The *true varicose aneurysm*, or *aneurysmal varix*, in which there is an expansion of the artery, to a greater or less extent of its length, often throughout the entire length of the trunk of the vessel, and of its principal branches, exactly as in varicosity of the veins. Besides this transverse expansion, there is also a lengthening of the vessel, which becomes bent, and describes more or less numerous and considerable curves. There are also sometimes observed, besides this, sudden expansion of the whole arterial cylinder, at certain parts, knots; or little circumscribed aneurysms, which are true sac-shaped and often mixed aneurysms. Very frequently the walls are thinned, softened, and falling together like those of varicose veins, whilst in true cylindrical aneurysm the walls are thickened. The artery affected with *varix* has great resemblance to a varicose vein; the pulsation, however, always presents a distinguishing and determinate character.

1402. The symptoms which characterize aneurysm are the following:—A little elastic pulsating swelling, which diminishes on pressure, and soon returns on its withdrawal, arises at some one spot corresponding to the course of the artery. The pulsation ceases when the artery is compressed between the swelling and the heart, and the former becomes generally less tense. If the artery be compressed below the swelling, the pulsation becomes more bounding and distinct. The tumour is usually free from pain, the skin over it unchanged, and it quickly enlarges to a considerable size. In proportion as the swelling increases, the blood contained in it becomes more solid by coagulating, and can be no longer got rid of by pressure; the pulsation is weaker, and often entirely lost (1). When the tumour has acquired considerable size, it acts injuriously by its pressure and expansion upon the neighbouring parts; the circulation in the diseased artery, in the other blood and lymphatic vessels, is interfered with; the nerves are compressed; the nourishment, warmth, and sensation of the part are diminished; the limb becomes œdematously swelled; the tumour is covered with varicose vessels, and becomes bluish; and the surrounding muscles, and bones even, may be destroyed by the constant pressure and absorption. In consequence of the expansion of the parts covering the swelling, they at last inflame; at the most prominent part an abscess, or commonly a slough is formed, after the separation of which the coagulated blood is discharged, and a dangerous or fatal bleedinge nsues (2). The coverings of the tumour may be also torn by gradual distension. Its size may even become so great, that by the pressure and destruction of the surrounding parts, the nourishment of the limb may be entirely prevented, and its death caused (3).

If the aneurysmal sac increase, it attaches itself to the surrounding parts, which are thickened by inflammation and by the exudation of plastic lymph, and thus enabled, although the coats of the artery be torn, to prevent the penetration of the blood into all the interspaces of the part. If, however, the aneurysmal sac tear suddenly before these adhesions are formed, the blood is poured forth into all the interspaces of the part.

[(1) "The coagulation takes place," observes JOHN HUNTER, "at the most distant parts from the direct current of the blood: the firmness and colour of the *laminæ*, in different parts of the tumour, are such that it is easy to distinguish an old *coagulum* from a new one; the external *laminæ* are of a dusty brown colour, and these *laminæ* grow gradually redder as we advance inwards towards the current of the blood. As the dilatation increases, the coats of the artery are thickened by the thickening process, or the cellular membrane already thickened becomes firm, and adheres from a consciousness of weakness. When the aneurism proceeds to this state it generally gives way to the circulation. It must be observed that the force of the blood on the sides of the sac diminishes in an inverse ratio to the increase of its sides, which, therefore, are longer in dilating than might be imagined; but after proceeding to a certain length, the adventitious coat gives way, and the blood is effused into the surrounding cellular membrane, producing distension; and when the artery is a considerable one, there is an obstruction to the blood's motion in the collateral branches, producing mortification. When the artery opens externally, it is always on that side where the artery gives way most." (p. 546.)

(2) The mode in which an aneurysm bursts externally is thus described by JOHN HUNTER. "When an aneurism is in an artery whose dilatation brings it to the skin, the *coagulum* comes first, and obstructs the circulation in the skin; the skin inflames and mortifies, forming a black slough, which dries and adheres to the *coagulum*. As the slough separates there is an oozing of blood at the edges, which becomes more and more, till at last in a large artery, as the *aorta*, the plug may be wholly pushed off and the patient die instantly. If in a smaller artery, death will be more gradual." (p. 546.)

HODGSON makes the following good remarks upon the bursting of "aneurisms, which, like abscesses, generally proceed towards the surface of the body; but in this respect they are very much influenced by the situation and the side of the vessel from which the disease originates. When the sac points externally it rarely or never bursts by laceration, but the extreme distension causes the integuments and investing parts to slough, and upon the separation of the eschar the blood issues from the tumour. A similar process takes place when the disease extends into a cavity which is lined by a mucous membrane, as the œsophagus, intestines, bladder, &c. In such cases the cavity of the aneurism is generally exposed by the separation of a slough which has formed upon its most distended part and not by laceration. But when the sac projects into a cavity lined by a serous membrane, as the *pleura*, the *peritoneum*, the *pericardium*, &c., sloughing of these membranes does not take place, but the parietes of the tumour, having become extremely thin in consequence of distension, at length burst by a crack or fissure, through which the blood is discharged. I have," says he, "examined aneurisms that have burst into the cavities of the *pericardium*, the *pleura*, and the *peritoneum*, and the opening has always been formed by laceration, and not by sloughing: on the other hand, all the instances of this disease that I have seen, in which aneurisms burst upon the surface of the body or into cavities lined by a mucous membrane, the opening has been the consequence of sloughing and ulceration, and not of laceration." (pp. 85, 6).]

(3) When aneurysms burst into mucous canals, they do not generally seem to protrude much into their cavity, but the walls of the aneurysm and of the canal becoming adherent, ulceration takes place, and in this way the blood escapes from the sac and often very quickly destroys the patient.

The same thing also happens in that very rare termination of aneurysm by bursting into another artery, an example of which is given by Dr. WELLS (*a*), and the preparation is in the Museum at St. Thomas's Hospital. The following is an extract of this interesting case:—

A fair-complexioned, thin, and temperate man, 35 years old, was in 1789 affected with symptoms supposed to denote the approach of pulmonary consumption, but after some time they disappeared. Nine years after he had a slight attack of hemiplegia, from which, however, he soon recovered. In March, 1804, he was frequently troubled with noise in his ears, flatulence, and pains in his hands and feet, from one or other of which he was never after free, but he never complained of any unusual feelings about his chest. On the 11th of August, 1807, having fatigued himself a good deal with walking, and eaten a full dinner, he fell asleep, awoke much refreshed, and played with his children in the garden. "While thus amusing himself, he was suddenly seized between eight and nine in the evening with a sense of great oppression in his chest. He soon after became sick and vomited; in the matter thrown up some streaks of blood were observed. He now went to bed, but though the weather was warm, and he was covered with bed-clothes, his skin felt cold to those who were attending on him. Soon after midnight he laboured under a constant desire to cough, and was continually expectorating mucus tinged with blood. His body was moistened with a cold sweat, his pulse was extremely feeble, sometimes it was scarcely perceptible." He continued getting worse through the night, "his breathing became difficult, and he frequently tossed and writhed his body as if he was suffering great pain and uneasiness, About a quarter past five he suddenly became worse, and expired. Almost immediately before his death he complained much of heat in his chest, and threw off the clothes to cool himself." On *examination*, "the blood-vessels of the lungs were found very much distended, and there was also a considerable quantity of blood in the air-cells. The right lung adhered slightly to the ribs and *pericardium*; but this seemed to have

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(*a*) Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. iii.

been the consequence of some disease which had existed long before death. Each cavity of the chest contained about ten ounces of a fluid highly tinged with blood; the *pericardium* contained about two ounces of a fluid similarly tinged. The ascending *aorta* was distended to about the size of a large orange. The tumour adhered to the pulmonary artery, just before its division, into the right and left branches. Within the circumference of this adhesion there was a narrow hole, by means of which a communication was formed between the two arteries. The cavities of the heart, and the great blood-vessels, were very much distended with blood." (p. 88.) In the Museum at the Royal College of Surgeons, there is one specimen of aneurysm of the arch of the *aorta* burst into the pulmonary artery close to its valves by an oval opening half an inch in its greatest diameter; and also a second, in which there is a small round aperture between the sac and the trunk of the pulmonary artery. The patient died of jaundice and dropsy; but the aneurysm was not indicated during life.

It may be here mentioned that the pressure of an aneurysmal sac will sometimes produce obstruction in the neighbouring vessels. In St. Thomas's Museum there is an example of complete obstruction of the *superior vena cava,* and *vena innominata,* by an aneurysm of the aortic arch involving also the *arteria innominata;* in the Museum at Fort Pitt, Chatham, is one in which the *superior vena cava* is obliterated; and in the College Museum, one in which the *superior vena cava* is almost obliterated.]

1403. The distinguishing characters of circumscribed true and false aneurysm, are usually described as the following:—True aneurysm quickly diminishes on the application of pressure, though it reappears almost as soon as the pressure is removed: false aneurysm only disappears gradually, and returns slowly after pressure has been taken off, because the blood can only gradually pass from the sac into the artery, and from it again into the sac. A distinct sound is often observed when the blood again flows into the sac (1). The pulsation is weaker in false than in true aneurysm, and sooner becomes indistinct in the enlargement of the swelling. The aperture by which the sac of the false aneurysm is connected with the cavity of the artery, is narrow in comparison with its base; in partial extension of all the arterial coats, the entrance for the blood is just as wide as the base of the sac. When the extension occupies the whole tube of the artery, the swelling is always cylindrical or egg-shaped, yields easily to pressure, and in the dead body is always found smaller than it was during life. The form of the false aneurysm is irregular, and continues the same in the corpse. In the sac of a true aneurysm, layers of coagulated blood are never deposited, which is always the case in false aneurysm, with very rare exceptions (*a*). The more all the coats of the artery are expanded the more they are thinned, whilst, on the contrary, the sac of a false aneurysm increases in thickness (*b*). However, in true cylindrical aneurysm the walls may be equally thick, so that, if cut through vertically to its axis, the walls do not drop (*c*).

[(1) LAWRENCE (*a*) observes:—" There are some instances in which pulsation cannot be felt, in which it may be heard, either by the application of the ear directly applied to the tumour, or through the medium of the instrument called the stethoscope. The sound that is communicated in either of these cases is very peculiar, the sound produced by the passage of the stream of blood from the opening in the artery leading to the aneurismal sac. The blood passes through comparatively a contracted orifice, to enter into a large cavity, and each jet of the blood propelled into the aneurismal tumour by the contraction of the heart, produces a sound which is something like that of the sound of blowing through bellows—*whih, whih, whih;* you will hear a succession of these; and hence the French, in my opinion, have very appositely characterised it by the term *bruit de soufflet; soufflet* is the term used for bellows: and, in fact, it means ' noise of a bellows;' and, in short, it cannot by any terms be more clearly illustrated." (p. 160.)

(*a*) HODGSON, above cited, p. 82. (*b*) SCARPA.
(*c*) BRESCHET, above cited.

I cannot assent to several of the conditions laid down by **Chelius**, as distinguishing true from false aneurysm. The diminution of the bulk of a true aneurysm depends materially on the stage at which it has arrived; if it be recent, and there be little or no lining of clot, it does diminish readily on pressure of the artery between the sac and the heart; but the diminution under these circumstances is less and less, in proportion to the increased bulk of the sac, so that, in a large aneurysm there is, comparatively, little diminution of size, though the current of blood be stopped. False aneurysm diminishes still less, and often, indeed, when the blood continues, as it commonly does, pouring into the cellular tissue it there coagulates, scarcely any perceptible diminution of size is made by pressure on the artery between it and the heart. And a true aneurysm which has burst a sac beneath the skin, as sometimes happens, is similarly circumstanced. The pulsation is generally less distinct in a false than in a true aneurysm; but this also depends on the period and extent occupied by the blood which has escaped, and is proportionally less, the greater the quantity of blood poured out. The external form of a false aneurysm is undoubtedly irregular, as it much depends upon the looseness of the surrounding cellular tissue, and whether the part be or be not enveloped in a tendinous sheath; but the immediate sac, consisting only of more or less numerous layers of coagulated blood, which, as they continue to form, thrust the loaded cellular tissue away from the artery, and hollow it out for their own lodgment, is generally of a regular oval form, and has at one or other part an aperture, by which blood continues escaping and gorging the cellular tissue surrounding the false sac, till at last it distends the skin so much that it mortifies and gives way at one or more points, and bloody serum and clots mixed with ill-formed pus, which is commonly produced towards the termination of the disease, begin to be discharged, and increase in quantity till the false sac itself break away and the blood readily makes its way out. I cannot understand the observation, that "in the sac of a true aneurysm layers of coagulated blood are never deposited," which is, most undoubtedly, incorrect in all cases where the aneurysm results from ulceration or tearing of one or other coats of the artery; for very speedily after a pouch is formed, layers of clot begin to form. And even when the disease only depends on dilatation of the arterial coats, though at first there be no layers of clot, yet as the disease proceeds, they are certainly formed, although **Hodgson** denies it, and says:—"In those sacs which consist either in a general or partial dilatation of the coats of the vessel, I have never met with it." (p. 82.) As to the difference of thickness of sac in true and false aneurysm, although in the former the coats of the artery thin, as the disease increases, yet there is a continued slow inflammatory action going on upon the external surface of the sac by which its thickness is preserved, till the parts by which it is surrounded having been either absorbed or stretched to bursting by its size, the sac itself is the only remaining resistant to the impulse of the blood, and in its turn yields, thins, and at last it bursts. As to the thickening of a false aueurysmal sac, it continues indeed so long as the surrounding cellular tissue confines and supports it, but when the tissue is absorbed or sloughs, the want of support is here also felt, and the false sac thins, yields, and bursts as in true aneurysm.—J. F. S.]

1404. The distinction of aneurysm from other swellings is grounded on the pulsation, the diminution by pressure, the reappearance when the pressure is removed, and the position corresponding to that of the course of an artery. When therefore the pulsation is indistinct, or not at all perceptible, and the swelling cannot be diminished by pressure, it must be the more carefully examined, and attention paid to its origin and its early condition. Swellings in the neighbourhood of a large artery, or lying upon it, participate in the pulsation, which, however, to a practised touch is easily distinguishable, as it consists only in a raising and sinking of the swelling; but if such swelling contain any fluid which undulates by the imparted motion, the *diagnosis* is doubtful: a degree of certainty, however, may be attained, if the artery be compressed above the swelling, and the latter be then properly examined (*b*).

[Aneurysms are sometimes mistaken for abscesses. **Dupuytren** witnessed a case in which the blood issuing from an aneurysm of the arch of the *aorta*, made its way behind the breast-bone into the bottom of the neck, and there formed a tumour, which,

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(*a*) Lect. on Surg.; in Lancet, 1829-30, vol. ii.

(*b*) **Ribes**, Mémoires et Observations d'Anatomie, de Physiologie, de Pathologie, et de Chirurgie, Paris, 1841. vol. i. p. 255.

being mistaken for an abscess, was punctured, and gave rise to repeated, and at last fatal bleedings. RICHERAND (*a*) says, that "FERRAND, principal Surgeon at the Hôtel-Dieu, thinking to open an abscess in the armpit, plunged his knife into an axillary aneurysm, and killed his patient." (p. 72.) ASTLEY COOPER mentions an instance of an aneurysm which had presented in the loin, being punctured, under supposition of it being a lumbar abscess; the mistake, however, being ascertained, the edges of the wound were immediately brought together and healed, and the patient died by the tumour afterwards bursting internally. (p. 35) I myself recollect a spurious aneurysm, after venesection, having been punctured as an abscess; the bleeding was stopped immediately, but about twenty hours after, as the girl was dressing her hair, the bandage slipped off, a violent gush of arterial blood followed, and she lay in great jeopardy for many hours before she was in a fit state to have the artery secured.

On the other hand, a pulsating tumour may be mistaken for an aneurysm, an example of which is mentioned by WARNER (*b*), in a boy who had his breast-bone much fractured by a fall, and came to Guy's Hospital a fortnight after. "There was an evident separation of the broken parts of the bone, which were removed at some distance from each other. The intermediate space was occupied by a tumour of considerable size; the integuments were of their natural complexion; the swelling had as regular a contraction and dilatation as the heart itself, or the *aorta* could be supposed to have. Upon pressure, the tumour receded; upon a removal of the pressure, the tumour immediately resumed its former size. * * * The event was, the tumour burst in about three weeks from his admission, discharged a considerable quantity of matter, and the patient did well by very superficial applications." (p. 155.)

Sometimes a large *varix* of the accompanying vein may turn so completely over the artery as to hide it completely, and receive its pulsation. In St. Thomas's Museum there is a very fine example of this disease in the internal jugular vein, the swelling of which, from its size, must have occupied nearly the whole of the one side of the neck. Such cases may be distinguished by pressure of the swelling at its farthest extremity from the heart, in which case its size will diminish, whilst if pressure be made between it and the heart its bulk must be increased, which is the very reverse to aneurysm.

Tumours of any kind upon an artery will often acquire pulsation from it, and be liable to mistake; their unvarying size, however, and commonly the cessation of the pulsation when the swelling is lifted up, will generally determine their true character.—J. F. S.]

1405. Aneurysms arise either of their own accord, or after determinate external influence (*A. spontaneum* and *traumaticum.*) In the former case they occur generally at more than one spot, either at once or consecutively, and thus show that a peculiar morbid condition spreads more or less over the arterial system. This is observed most commonly in persons who are subject to rheumatism, gout, *scrofula*, *syphilis*, who have used much mercury, and have drank spirits to excess. In these cases there frequently arise inflammation of the internal coat of the artery, ulceration, loosening, thickening, even ossification between the internal and middle coats, by which the walls of the artery yield to the pressure of the blood, or the internal and middle coats are torn or destroyed. The external influences which produce aneurysm are wounds, violent efforts in lifting heavy weights, in jumping, in vomiting, coughing, and the like. These circumstances (wounds naturally excepted) produce aneurysm the more readily, if the coats of the artery have been changed by disease, as above mentioned.

[RICHERAND mentions a curious circumstance in reference to "a class of persons who almost always die of aneurysm, and whom he noticed whilst engaged with anatomy. These were the servants of the amphitheatre, whose business it was to bring the subjects and remove the refuse of the dissections. I never saw one," says he, "who did not abuse spirituous liquors, and was not constantly drunk; and to this were added the feebleness resulting from such excess, the fatigues of so disgusting and laborious an occupation which occupied their nights, the exertions required to carry bodies often too heavy for a single person, wearied with sleep and drunkenness." (p. 71.)

(*a*) Nosographie Chirurgicale, vol iv. Fourth Edit. Paris, 1815.
(*b*) Cases in Surgery. London, 1784.

Guthrie also observes:— "The exertion in general is infinitely greater in the man than in the woman; and I think this, combined with the freer use of ardent spirits, a much more likely predisposing cause than either *syphilis* or mercury." (p. 87.)

With regard to the age at which aneurysm occurs, **Astley Cooper** observes (*b*):— "The period of life at which they most frequently occur is between thirty and fifty years; at that age in the labouring classes the exertions of the body are considerable and its strength often becomes diminished: in very old age this complaint is less frequent, as muscular exertion is less. The greatest age at which I have seen aneurism has been eighty years; this was in a man for whom I tied the popliteal artery in Guy's Hospital, for popliteal aneurism; and, notwithstanding his advanced age, I never had an operation succeed better. I also operated on a man of sixty-nine years, and that case also did well. A boy, in St. Thomas's Hospital, had an aneurism of the anterior tibial artery, who, I was informed, was only eleven years old. The man of eighty was the oldest, and the boy of eleven the youngest, which I have seen with aneurism." (pp. 40, 1.)

As regards the frequency of aneurysm in the sexes, **Wilson** (*a*) remarks, that shortly before **John Hunter's** death, he heard him state that he had only met with one woman with true or spontaneous aneurysm. **Astley Cooper** says:—"In forty years' experience, taking the hospital and private practice, I have seen only eight cases of popliteal aneurism in the female, but an immense number in the male. The aneurisms which I have seen in the female, have been the greater number in the ascending *aorta* or the carotid arteries." (p. 41.) Of the sixty-three cases referred to by **Hodgson**, seven only were females, and the other fifty-six males. (p. 87.) **Guthrie** states, that he "does not recollect having seen more than three women suffering from popliteal aneurism; and it is probable that they are found, on an average, at least, from twenty to thirty times, in men for once in woman. The structure of the vessels is the same, but the mode of life is different." (p. 87.) **Lisfranc** (*b*) mentions that of one hundred and fifty-four cases which he had collated, one hundred and forty-one were males, and thirteen females. I myself, in the course of thirty years, do not recollect more than three external aneurysms, which were popliteal, in females.—J. F. S.]

1406. Aneurysm may occur in all arteries: the internal arteries are, however, more frequently attacked with it than the external, the reason of which may be, that the nearer the arteries are to the heart, the thinner are their walls in proportion to their diameter, consequently they are less capable of withstanding a violent pressure of the blood. The curves, also, which the arteries describe in their course, have an influence on the more frequent origin of aneurysm. Aneurysm of the arch of the aorta is most frequent; next comes aneurysm of the popliteal, then of the inguinal, axillary, and carotid arteries. False aneurysm, as a consequence of the wound of an artery, occurs most commonly in the brachial, after an unlucky blood-letting.

["The force of the heart, however," says **John Hunter**, "has some power in operating as a remote or first cause of aneurisms. Aneurisms are most frequent in the larger arteries, as at the arch of the *aorta*, and more frequent in the second order of arteries than in the third; but they are sometimes found even in the fourth and fifth.
* * * The nature of the artery contributes likewise, the structure of the large arteries being chiefly of elastic matter, and not near so muscular as the small ones, which have therefore greater powers of resistance." (pp. 544, 45.)]

Of the comparative frequency of aneurysm in the different external arteries, the following tables are given by **Hodgson** and by **Lisfranc**:—

Hodgson.

Popliteal and Femoral	14 males.
Ditto	1 female.
Carotid	2 males.
Subclavian and axillary	5 „
Inguinal	12 „
Total	34

Lisfranc.

Popliteal	59
Femoral, at the groin	26
„ other parts	18
Carotid	17
Subclavian	16
Axillary	14
External iliac	5
Brachio-cephalic	4
Brachial	3
Common iliac	3
Carried forward	165
Brought forward	165
Anterior tibial	3
Gluteal	2
Internal iliac	2
Temporal	2
Internal carotid	1
Ulnar	1
Radial	1
Palmar arch	1
Peroneal	1
Total	179

(*a*) Lectures on the Blood, and the Anatomy, Physiology, and Pathology of the Vascular System. London, 1819. 8vo.

(*b*) Des diverses Méthodes et des différens Procédés pour l'Oblitération des Artères dans le traitement des Anévrysmes. Paris, 1824. 8vo.

Not unfrequently there is more than one aneurysm existing at the same time: it, therefore, becomes a matter of high importance to make a careful examination of the whole of a patient's body upon whom it is proposed to operate; for if there be any internal aneurysm, it is useless to subject him to an operation from which he can derive no real benefit, as the internal aneurysm will sooner or later destroy him. Astley Cooper mentions that "the elder Cline was about to operate upon a man in St. Thomas's Hospital who had a popliteal aneurism, but deferred it on account of the patient's complaining of a pain in his *abdomen.* A few days afterwards the man died suddenly, and, on examination, an aneurism was found between the two emulgent arteries, which had burst into the abdomen." (p. 30.) Or the excitement of an operation may cause the bursting of an internal aneurysm, which happened with a patient upon whom Astley Cooper had commenced operating for popliteal aneurysm. "The patient stretched himself on his back, and his urine flowed from him; * * * he gave a deep gasp, and in a few minutes was dead. The next day," says Cooper, "I opened the body, and found the *pericardium* distended with blood, which had escaped from an opening seated at the beginning of the *aorta*, immediately above the semilunar valves." (p. 29.) The preparation is in the Museum at St. Thomas's Hospital.

Sometimes many aneurysms are met with in the same person. Astley Cooper tied the external iliac artery for an aneurysm at the origin of the *profunda*, and another in the middle of the thigh; the man died afterwards of aneurysm at the bifurcation of the *aorta*, which burst into the belly. "Upon examination, an aneurism was found in each ham; one at the bifurcation of the *aorta*, one at the origin of the *arteria profunda*, one in the middle of the thigh, and two between the popliteal aneurism and the femoral, making in all seven aneurisms." Tyrrell, in a note upon this case, mentions another instance in which he operated on a man who was afterwards found to have seven aneurisms." The operation was performed for a popliteal aneurysm in the left ham. "Whilst feeling in the course of the artery, before commencing the operation, I found," says Tyrrell, "a small aneurism near the part in which I had intended to secure the vessel; this led to a more minute examination of the patient, and at that period another aneurism was found just above the tendon of the *triceps*, on the same side, making two femoral aneurisms and a popliteal on the left side. On the right side the artery felt dilated in several places, but a little below Poupart's ligament an aneurism existed as large as an egg. After further consultation, it was decided that I should tie the femoral artery between the two small aneurisms, as we feared that a ligature in the external iliac would not command the hæmorrhage from the aneurismal sac," (which had been punctured to ascertain its character, previously very doubtful.) The space between the two aneurisms in the femoral was about an inch, or an inch and a half, appeared sound, and a ligature was applied on it. During the following three weeks the limb became gangrenous, and the aneurismal sac in the ham sloughed, exposing the thigh-bone, but amputation was not performed, for fear of the diseased condition of the artery. "The ligature did not separate from the wound until the sixth week, and the patient lingered till the 28th of July," (eight weeks and a half after the operation.) "The popliteal and inferior femoral aneurisms of the left side had been destroyed by the sloughing; that above the ligature was not closed. On the right side were found three femoral aneurisms, and a small popliteal, making in all seven; besides some dilatation of the *aorta*, immediately above the bifurcation," (pp. 38,'9.)

Still more remarkable is the case mentioned by Pelletan (*a*), who observes:— "I have often seen numerous aneurysms affecting indifferently the large and small arteries, but specially those of size; I counted 63 in one man, from the size of a filbert to that of half a pullet's egg," (p. 1.) And in another case, related by Cloquet (*b*), "all the arteries were studded with aneurismal tumours from the size of a hempseed to that of a large pea. Some were on the *aorta* and its principal divisions, but they projected little and were much less numerous than on the arteries of the limbs," which, "on many parts of their length, formed kinds of necklaces; all the swellings were numerous and close together. Those of the lower limbs were perhaps less numerous; without exaggeration they might be estimated at several hundreds. The arterial walls seemed unaltered in structure, except at the swellings, where the tunics were dilated and thinned. In none did I observe rupture of the inner or middle coats." (p. 86.)]

1407. The old opinion that spontaneous aneurysm almost always depends on an expansion of all the arterial coats, has been disputed by many writers, but most efficiently by Scarpa, and *the origin of aneurysm placed in a tearing of the internal coat of the artery, effusion of blood through this tear, and expansion of the cellular sheath of the artery.*

(*a*) Clinique Chirurgicale, vol. ii.

(*b*) Pathologie Chirurgicale. Paris, 1831. 4to.

The correctness of this opinion is grounded on the condition of the arterial coats in their natural state, and on the careful examination of aneurysmal arteries. For the internal and middle coats of arteries cannot, on account of their slight degree of elasticity, permit any great degree of extension without tearing; whilst, on the contrary, their external or cellular coat is in the highest degree extensible. Examination shows that in all large aneurysms their proper sac communicates with the cavity of the artery by a large or small opening, frequently, as it were, fringed, and often hard and callous; that, therefore, the swelling never includes the whole tube of the artery, as would be the case in expansion of all the arterial coats, but is connected with the artery like an appendage fixed on a stem. Further, that in the wall of the artery, opposite the torn part, the several coats are found in their natural condition, and can be decidedly distinguished from each other; that in spontaneous aneurysm the internal coats are usually changed in a manner (*par.* 1405) which, indeed, favours their tearing, but not their extension. Also, in expansion of all the coats of the artery, no collection of coagulated blood can take place, as the blood always remains within the cavity of the vessel. The reason, however, why it is so easily assumed that the sac of the aneurysm is formed of all the coats of the artery, is founded on the cellular tissue being always considerably thickened, and at the commencement of the tear being adherent, in the closest manner, to the internal coats of the artery, which are here always more or less disorganized, often quite brittle. Besides, also, every remark usually applied to aneurysm by expansion, is equally applicable to aneurysm by tearing. Only in the *aorta*, near to the heart, does SCARPA admit the possibility of simultaneous expansion of all the arterial coats; however, even here it can only attain a certain degree, without tearing of the internal coat.

[JOHN HUNTER somewhat inclines to a diseased condition of the artery; for he says:— " It would appear that there must be a specific disease of the artery in most cases, for dilatation is too local for so general a cause as the force of the heart." (p. 545.)]

1408. Close and careful, however, as are the observations of SCARPA, and valid as is his opinion against the often too ready assumption of an extension of all the arterial coats in aneurysm, their truth cannot, however, be admitted in every case. Examinations instituted by the closest observers, show that the arteries are subject to an expansion, not only of their whole tube, but also of particular parts (*a*). SCARPA himself admits the possibility of extension of all the coats in the arch of the *aorta*. In old persons, especially females, the expansion of the arch of the *aorta* without degeneration or tearing, is twice as frequent. Even the trunk of that vessel has been found throughout regularly expanded to nearly double its size (*b*). Enormous expansion of the *aorta* and pulmonary arteries, are a common appearance in diving animals.

On examining an aneurysm in which the internal coat has been torn, and a considerable sac formed in the cellular coat, the area of the artery is often found considerably enlarged, at the place where the tear has occurred, and no other change in the inner and middle coats of the artery, than that they are expanded and thinned. The enlargement of the neighbouring branches of the arteries, if the circulation be in any way checked in the principal trunk, and the frequently considerable expansion of the capillary vessels in the branching aneurysm, presently

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(*a*) HODGSON, above cited, p. 74. BRESCHET, above cited.

(*b*) MECKEL, Handbuch de pathologischen Anatomie, vol. ii. pt. i. p. 244.

to be considered, contradict SCARPA's opinion. From these reasons, however, it only follows, that a simultaneous expansion of all the arterial coats is possible, but that when it attains a certain degree, tearing of the internal and middle coats occurs; consequently, a *false aneurysm* is produced from a *true aneurysm.*

1409. Although the above-mentioned (*par* 1372) results are the common terminations of aneurysm, and the disease, if left to itself, nearly always ends fatally, yet, however, it is capable of a spontaneous cure, which may be brought about in different ways.

1. If the aneurysmal sac attain considerable size, it may compress and obliterate the artery. This is the more rare case (1).

2. A severe inflammation which attacks the whole aneurysmal sac, and runs into suppuration or gangrene, may act so violently upon the artery itself, that its adhesion may be produced, and no bleeding occur after the bursting of the sac; but the suppurating part closes without any trace of aneurysm.

3. A deposit of clot in layers may take place in the sac, by which its cavity may be diminished, and at last even filled up. The clot extends into the canal of the artery, and closes it to the next collateral branch, above or below the swelling (2). This kind of spontaneous cure of aneurysm is announced by the swelling becoming solid, and by a weaker or completely stopped pulsation (*a*).

4. The clot contained in the sac may be converted into a solid, fleshy, steatomatous mass, by which the bursting of the sac is prevented; in which case, however, the area of the artery is preserved, and the sac gradually diminished by absorption (*b*).

In simultaneous extension of all the coats of an artery, spontaneous cure is impossible, because it never arrives at the deposition of a clot (*c*).

[(1) The obliteration of an artery by the lengthening of an aneurysm into a pouch-like form, at that side of the sac most distant from the heart, is well explained by JOHN HUNTER. He says:—"Even in the last-mentioned situation, (the leg,) the force of the heart directs, in some degree, the swell of the tumour; but that is not until the sac is a good deal enlarged. The force of the blood against the most distant part of the sac endeavours to carry it on further in the direction of the motion of the blood, which in time makes a pouch; therefore it is elongated in the direction of the sound artery. The sac often, by its increase, presses on the sound part of the artery, and becomes the cause of its obliteration, as I have seen more than once." (pp. 544, 45.) Of this kind of spontaneous cure there is a magnificent specimen in the Museum at St. Thomas's, in an aneurysm of the femoral artery, just below the *profunda*, which has formed a large long sac that has descended for several inches below its communicating opening, and has completely compressed the artery, which is full of clot even into the ham.

(2) There is in St. Thomas's Museum a very excellent example of a popliteal aneurysm, in course of cure by this proceeding; the clot in the aneurysmal sac is very close and solid, and through its centre is a track, less in diameter than the natural tube of the vessel, by which the blood has been conveyed to the leg, but which has been evidently fast diminishing. FORD's cases, presently to be noticed, appear to have been cured in this way. In the Museum of the College of Surgeons there is a globular axillary aneurysm, about an inch in diameter, filled with laminated clots, and the artery beyond it contracted.—J. F. S.]

1410. What has been said about the spontaneous cure of false aneurysm applies also to artificial assistance. For in general the cure of an aneurysm is only possible, in so far as a closing of the artery can be produced, or such a collection of the clot in the sac, as may withstand the pressure of the blood, and gradually contracts; the artery, however, remaining pervious.

(*a*) HODGSON, above cited, p. 114.

(*b*) Ib., p. 118.

(*c*) SCARPA.

1411. After the obliteration of the trunk of the vessel the circulation is carried on in the limb, by the collateral branches, which enlarge considerably, and are connected with each other by numberless anastomoses. In many cases a more direct and manifest anastomosis of the vessels take place, so that after the closure of the principal trunk, the stream of blood at once passes by the neighbouring branches ; in other cases, the collateral circulation is only undertaken by small numberless anastamoses (*a*). Upon the different ways in which the collateral circulation is produced, and partly also on the point of time when the vessel is examined, after the obliteration of the principal trunk, may depend *whether the collateral branches appear more or less, or even not at all, enlarged.* The frequent examinations, in which, after the obliteration of the principal trunk of an artery, the other arteries of the limb are found considerably enlarged, do not therefore contradict the equally true observations, in which this enlargement is not found (*b*).

1412. The remedies which have been proposed, generally, for the treatment of aneurysm, are, *rest and antiphlogistic treatment*, *the application of cold and contracting remedies to the swelling*, *the compression*, *and tying* of the aneurysmatic artery.

1413. Strict rest, lowering treatment, restricted diet, repeated blood-letting, even to the greatest degree of weakening, (Valsalva's plan,) and the internal use of *digitalis*, are the only modes of treatment by which the cure of internal aneurysm may perhaps be effected ; in which indeed, under great diminution of the circulating power, the blood coagulates in the sac, and the aperture, whereby the sac communicates with the artery, is closed. In certain cases the area of the artery may be at the same time preserved, (*par.* 1409,) but in others the coagulation of the blood extends into the atrery, and shuts it up. In true aneurysm, a diminution and contraction of the walls of the artery may thus be effected.

1414. The *astringent remedies* employed for the purpose of restoring their elasticity to the arterial coats, or for effecting the complete coagulation of the blood in the sac, are, applications of cold water, pounded ice (1), bark, oak bark, and so on. If this mode of treatment, which was formerly employed, have in many cases a satisfactory result, it may be in part ascribed to the compression generally at the same time employed with it, and more especially to keeping the patient at rest. Perhaps, however, all share in the business must not be denied to these topical applications, as they are capable of favouring the coagulation of the blood in the sac, and in this way promoting the cure (*c*).

[(1) Guérin, of Bordeaux, appears to have first proposed the application of pounded ice, or iced water, to the aneurysmal sac (*d*); and though its beneficial use was much doubted, yet Richerand says, that "subsequent observations have proved the advantage of pounded ice in the treatment of aneurysm. The examinations of the bodies of persons cured in this way, have dissipated all doubts as to the value of this remedy." And he mentions a case reported in the *Bulletin de la Faculté de Médecine de Paris*, No. 4, 1812, in which a popliteal aneurysm was thus cured. The patient lived a considerable time after the disappearance of the tumour, and the preparation is now in the Museum of the School of Medicine. On the contrary, Hodgson says :— "I have seen ice applied to a large inguinal aneurism, but it produced such excruciating pain that its employment was from necessity discontinued." (p. 163.)]

(*a*) Hodgson, above cited, p. 235.

(*b*) Fressling, Dissert. de sistendis hæmorrhagiis. Groen., 1804. Walther, Neue Heilardes Kropfes, u. s. w. Sulzbach, 1817. p. 65.

(*c*) Radeloose, H., Dissert. sur l'emploi des réfrigérans dans les Anévrismes externes. Paris, 1810.

(*d*) Recueil Périodique de la Societé de Santé, à Paris, No. 3.

1415. *Compression* and *ligature* of the aneurysmatic arteries are the two modes of treatment which especially apply to the cure of external aneurysms. They agree with each other in effecting the obliteration of the artery; this takes place slowly by compression, in which case the circulation is gradually restored by the collateral branches, but occurs quickly on tying the artery. Only in a spurious aneurysm, which arises from a wound in an artery, and has not long existed, can a cure by compression be effected, without subsequent closure of the artery, as has been already granted in wounds of arteries, under certain circumstances (*par.* 279.)

1416. Compression has been employed *upon the aneurysmal swelling, above it, and as a swathing of the whole limb.* Proper apparatus or bandages have been used for the purpose.

1417. *Compression of the swelling alone*, is on many grounds objectionable. It is difficult or impossible, on account of the depth of the artery, and the different size of the swelling, always to employ the compression properly, and in the same direction; the aneurysmal sac may be developed in another direction, and if the compression be made sufficiently great, severe pain, inflammation, and bursting of the sac, may be caused. Nor is it certain whether the pressure operates upon that part of the artery above the opening, by which the sac communicates with the artery, or upon the part below this opening, in which latter case the speedy bursting of the artery may be produced.

1418. Compression of the artery is to be made at that part above the aneurysmal swelling, where the artery is superficial and the surrounding parts afford a proper point of support for the compression; in doing this, however, care must be taken to avoid the collateral vessels above the swelling, especially the larger ones. All the contrivances by which this compression is effected, must be so managed that they compress the limb only on two sides, because otherwise they would check the circulation too much (*par.* 285.) The compression nust be gradually increased, with the greatest care, and so long continued till the obliteration of the artery is effected. This compression is often unbearable, when, for example, the artery is accompanied by the principal vein of the limb, or by considerable nerves. The femoral artery in its upper third, and the brachial artery, throughout its whole length, bear compression best. The position of the median nerve, however, close to the brachial artery, renders this less fitting, and the compression is painful. It is therefore especially applicable only to the femoral artery (*a*).

Here also may be mentioned alternate compression with several tourniquets at different parts.

Hutton and Cusack (*b*) have communicated cases of successful result from compression of the femoral artery in aneurysm of the popliteal artery, in which the compression was employed only for some hours, and repeated every day, or at longer intervals.

1419. The *compression of the whole limb*, by proper bandaging, in which, by the application of graduated compresses along the course of the artery, increased pressure is made, is not usually accompanied with inconvenience to the patient; the œdematous swelling disappears, and the cure may be effected by this simple remedy. The event of the cure in these cases appears always to be the complete coagulation of the blood in the

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(*a*) Guillier Latouche, C. H., Nouvelle manière d'exercer la Compression médiate prolongée sur les principales Artères des Membres Strasbourg, 1825. 4to.

(*b*) Dublin Journal of Medical Science, vol. xxiii., 1843, p. 364.

aneurysmal sac, depending on the arrest of the circulation throughout the whole limb.

[The unsatisfactory results of the treatment of aneurysm by tying the affected artery above and below the sac, opening and emptying the latter, either before or after the ligature, and then inducing it to fill up by granulation, as also the dangers of amputation, led GUATTANI (*a*) to consider the possibility of some other proceeding for the management of "a disease, so evidently incurable, that both medicine and surgery renounced all kind of treatment." He had, however, observed several cases spontaneously cured, in patients who would not submit to either of these operations, and he hoped to succeed by a somewhat similar process. "Many indeed," says he, "were the trials and dangers depending on the varieties of aneurysm, some of which differed from others in their nature; nor did all arise from one and the same spot. But when I especially inquired into those aneurysms which occurred at joints, I was led to suspect that by rest in bed and weakening the whole body, at the same time also restraining the flow of blood in the artery running to the affected part, and finally by gradually compressing the aneurysmal tumour itself by the aid of bandages, I might be able not only to prevent its increase, but that in course of time the grumous blood would, by little and little, of itself, be changed into serum, and rendered fit for circulation, and that the entire resolution of the tumour would at length take place. A methodical bandaging, which should from day to day more and more compress the affected part, seemed to me the only means which could fulfil all the indications; but as in doing this many hindrances occurred to me which seemed adverse to a happy result, I continued in doubt, whether I should entirely give it up, or whether at some future time I should be induced to practise it." (p. 129.) In this frame of mind he continued till 1757, when a case of aneurysm of the upper part of the femoral artery having occurred, he employed simple bandaging, which to a certain degree controlled the growth of the swelling. But the patient would not submit to the necessary rest, and left GUATTANI for another Surgeon, who tied the artery, and, probably opening the sac at the same time, bound it up very tightly, and the man died of mortification of the limb on the third or fourth day. As this could not be considered a satisfactory trial of his plan, he determined on trying it in another case, a spurious aneurysm, as he calls it, of the popliteal artery, and of which he commenced the treatment in November, 1765, according to the following manner:—"Having for some days previously," says he, "applied lint dipped in vinegar and water, I covered the whole mass of the tumour with lint, and then applied two oblong pillows across each other, like the letter X, upon the centre of the swelling, in such a way that the upper ends of both embraced the knee above and the lower below; another oblong pillow, wetted with vinegar and water, was then applied along the whole length of the femoral artery to the groin, and moistened all the lint surrounding the knee and covering the whole extent of the thigh. I then employed a strong long bandage, three inches wide and no more, and having made the first turn upon the centre of the swelling, carried it around both above and below, in the usual way of bandaging the joint, and wound it round sufficiently to cover up and compress it equally. In the same way I bound the whole length of the thigh up to the groin, and in order to render it more secure, made a couple of turns round the trunk, and so completed the bandaging. I took special care that the first turn of the roller should not too much constringe the part, and was very cautious that the pressure should be equally kept up, so that every turn of the bandage covered the preceding one rather more than half its breadth; which indeed, in every surgical operation where this indication presents, should always be done." (p. 131.) Blood-letting, low diet, complete rest of the joint, and the application of spirits of wine, were ordered. "I left the bandage undisturbed," he continues, "as long as it performed its duty. If properly applied, it would remain for eighteen or twenty days. * * * In re-applying I always took care it should be put on somewhat tighter. I also directed moderate blood-letting, especially when either the leg or foot swelled in the least, which prevented the renewal of the bandage if by chance it became tighter than the patient could bear. Subsequently the lint and pillows were moistened with vinegar and water, that I might prevent too much heat of skin, which coming on might have delayed not a little the cure. By patient and assiduous use of this treatment I was delighted to find that the swelling, although it constantly preserved its hardness and pulsation, daily decreased more and more; so that, indeed, after three months, I had the great pleasure of seeing the patient leave the hospital perfectly cured. Nothing remained of it at the place of the torn artery but a callosity, scarcely the size of a large

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(*a*) Quoted at head of Article in LAUTH's Collectio.

bean." (p. 132.) Such was the treatment GUATTANI adopted and continued to practise with success, and upon it has been founded the practice of others at a subsequent period.

JOHN HUNTER tried compression in one of his cases, but the patient could not bear it, and he was obliged to tie the artery.

In the beginning of 1802, BLIZARD (afterwards Sir WILLIAM) attempted compression of the femoral artery in a case of popliteal aneurysm, with the hope of effecting obliteration, in the following manner (*a*):—" The points of support for the instrument were the outer part of the knee and the great *trochanter*, a piece of steel passing from the one to the other: and to the middle of this a semi-circular piece of iron was fixed, which projected over the femoral artery, having a pad at its end moved by a screw, by turning which, the artery was readily compressed, and the pulsation in the aneurysm stopped, without any interruption to the circulation in the smaller vessels. But although the patient possessed unusual fortitude of mind, and indifference to pain, he was incapable of supporting the pressure of the instrument longer than nine hours; and when it was loosened, the pulsation in the tumour returned with unabated force. After a fair trial of this plan the man quitted the London Hospital; and his femoral artery was tied by ASTLEY COOPER in the following April, in the then usual way, with two ligatures and division of the artery between. He did well.

In 1807, FREER, of Birmingham (*b*), having witnessed two cases in which GUATTANI's treatment had been adopted, " does not hesitate to recommend the cure of aneurism to be attempted, in the first instance, by pressure, rather than by an operation, which frequently occasions death, even when the patient might have recovered, if left to nature alone." Compression may be applied either on the aneurismal tumour itself, or upon the sound artery above it. In those cases, where pressure has been hitherto applied, it has been upon the tumour itself; and though this mode of application has frequently been attended with success, it is by no means so likely to answer the intention of uniting the sides of the vessels, as when used on the sound part of the artery. From the result of those experiments I made upon the radial artery of a horse, I should recommend the pressure to be applied on the extremities, either by the assistance of SENFFIO's instrument, or in the following manner:—First, place a bandage moderately tight from one extremity of the limb to the other, then place a pad upon the artery a few inches above the tumour, that you may have a greater probability of its being in a sound state; then, with a common tourniquet surrounding the limb, let the screw be fixed upon the pad, having previously secured the whole limb from the action of the instrument, by a piece of board wider than the limb itself, by which means the artery only will be compressed when the screw is tightened; the tourniquet should then be twisted till the pulsation in the tumour ceases. In a few hours, as by experiment in the horse, the limb will become œdematous and swelled; the tourniquet may then be removed, and no stronger pressure will be required than can easily be made with the pad and roller. The irritation produced by this mode of pressure, excites that degree of inflammation of the artery which deposits coagulable lymph in the coats of the vessel, thickens them, diminishes the cavity and eventually obstructs the passage of the blood." (pp. 112,13.) HODGSON mentions two cases in which this mode of treatment was adopted: in the one, a popliteal aneurysm, the pressure could not be supported longer than two hours, and in the other, where " it was applied to the brachial artery, the pain and swelling of the limb was so considerable that the Surgeon was compelled to abandon the practice."(p. 177.)

RICHERAND (*c*) observes, that if " the compression be made above the aneurysm, the compressed artery must be superficial, and have a solid *point d'appui* in a neighbouring bone. The compression also must not operate on the whole circumference of the limb; if spread over too large a surface, it will be too weak to press down the walls of the vessel; it will uselessly cause severe pains, produce swelling of the limb, by opposing the return of the lymph and venous blood; and it will hinder the passage of the blood through the collateral vessels, and consequently tend to produce want of nourishment, and gangrene of the limb, by obliterating all its vessels, on which account circular compression is to be entirely discarded in cases of aneurysm. * * * A tourniquet, or any analogous instrument, should be used, which will make a strong pressure on a particular part of the artery, and at a part directly opposite; whilst the limb remains free from all compression at any other part of its circumference." In illustration of this method, he mentions a case of popliteal aneurysm, in which, for a whole year, complete quiet, lying in bed, low diet, bleeding every month, and pressure, where the artery passed through the tendon of the *m. triceps femoris*, were employed. " The compression was effected by a semi-circular steel spring, like that of a rupture truss; a screw, with a pad

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(*a*) From a paper of ASTLEY COOPER's on Aneurism, in Med. and Phys. Journ., vol.viii. p. 2. 1802.

(*b*) Quoted at head of Article.

(*c*) Nosographie Chirurgicale, vol. iv.

at its end, graduated the pressure on the vessel at will. The pain at first prevented its constant application; but, by gradually accustoming himself to it, and increasing the force, he succeeded in weakening, and then in preventing the pulsations of the swelling, which became adherent, hardened, and reduced to a little tubercle, formed doubtless by the coagulated blood, and adherent to the inside of the aneurysmal sac. The practice of Professor Dubois presents many instances of success by the same means." (pp. 95, 6.)

Compression for the cure of aneurysm, has, however, been little thought of, or employed in this country, till within the last four years, when it was revived by Hutton, of Dublin (*a*), for a case of popliteal aneurysm, as large as a hen's egg, as the patient would not submit to the operation of tying the femoral artery. "For three or four weeks he maintained the horizontal posture, and a compress and bandages were applied; but, as the tumour gradually increased in size, and as he suffered pain from the pressure, this treatment was discontinued." On the 1st *Nov.* 1842, Hutton therefore applied an instrument, "so contrived as to admit of pressure being made by a screw and pad upon the course of the femoral artery, and the counter-pressure upon the opposite surface of the limb, without interfering with the collateral circulation. In the first instance, the compression was made upon the femoral artery in the middle third of the thigh; and, although it was effectual in compressing this vessel, it produced so much uneasiness that it could not be sustained, and, after a few applications, the apparatus was removed, and adapted to the upper part of the limb. *Nov.* 12. The femoral artery was compressed as it passes from the *pelvis* under Poupart's ligament, and the pressure maintained for more than four hours. *Nov.* 14. The tumour feels rather more solid; the purring thrill before felt, on the re-entrance of the blood into the sac, is no longer sensible; the pulsation as before. *Nov.* 22. Duration of compression three hours; the pulsation returned after its removal. *Nov.* 24. Artery compressed six hours; same result. He could not bear pressure next day for soreness in the groin; and he had some pain in the tumour. *Nov.* 26. The compression resumed, and continued for four hours; when the instrument was removed, the pulsation had ceased in the tumour, which felt solid, and was free from pain. *Nov.* 27. The pulsation had in a slight degree returned; compression for six hours. *Nov.* 28. No pulsation was now felt in the tumour. It had decreased in size, and was solid. *Nov.* 29. The compression was maintained for six hours; no pulsation felt; compression applied three hours. *Dec.* 1. An artery, about the size of the temporal, is felt pulsating along the surface of the tumour, which is quite solid, much diminished in size, and is altogether free from pulsation. The use of the instrument was now discontinued. *Dec.* 27. The tumour reduced to the size of a small walnut, and very hard. He was this day discharged at his own request." (pp. 364, 65.) Very soon after the termination of this case, Cusack treated a popliteal aneurysm in the same way, beginning first with a bandage over the whole limb, to which subsequently was added a compress on the aneurysmal sac; this was continued for a month, but without effect. "*Feb.* 22. Hutton applied his instrument, the pad being screwed down on the femoral artery at as high a point as possible, and with a force sufficient to stop completely the pulsations in the tumour; a compress was then laid over the aneurism, and secured by a flannel bandage, beginning at the toes. He soon began to feel uneasy; but when it had been on for one hour and a half, his face became pale, his pulse weak and slow, and he complained of faintness, with a feeling of weight in the situation of the pad, running up to his heart, and a sensation of a rush of blood to his head, accompanied by profuse perspiration on the forehead and vertex; the instrument was now loosened, and he soon rallied. When quite recovered, the pad was again screwed down; but he could not bear it for more than half an hour at a time." The apparatus was continued for five days, the patient screwing down the pad as he could bear it; but no benefit having been gained, it was put aside, and a bandage applied. From the 22nd January to the 4th of March, he had been taking ten drops of tincture of digitalis thrice a day; but it was then increased to fifteen drops, which was continued a fortnight longer, and then left off entirely. "*March* 16. Sir P. Crampton's instrument, modified by Mr. Daly, was put on so as merely to lessen the impulse in the aneurism; no compress or bandage was put on the tumour. *March* 18. Bears this instrument much better than the last; has none of the unpleasant rush to the head. * * * No change in the tumour. *March* 22. The tumour is decidedly harder and smaller, the impulse being greatly lessened. At times there is only a thrill in the aneurism; sometimes there is no motion whatever in the tumour, even when the pressure is removed, but it returns on the slightest movement of the body. *March* 23. Pulsation has totally ceased; the tumour is very hard, and about the size of a large walnut; a large artery can be felt running down superficial to the aneurism, over which it can be easily rolled with the finger; it then divides into two

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(*a*) Dublin Journal of Medical Science, vol. xxiii. 1843.

branches; the articular vessels do not appear enlarged. *March* 25. The instrument was removed to-day. The femoral artery can be distinctly traced as far as the opening in the tendons of the *triceps* and *vastus internus*. *April* 1. The tumour is decreasing; the enlarged artery above mentioned is much smaller than at the last report. *April* 7. Tumour continues to decrease; the entire artery can be traced until it enters the aneurism; but in the lower third of the thigh, and in the ham, the pulsation is so weak that it can only be felt on a careful examination. *April* 14. The enlarged artery has become very small, while the popliteal artery of the affected limb now pulsates as strongly as that of the sound one; a number of hard cords can be felt passing over the tumour." (pp. 367, 68.) In the spring of the same year (1843) BELLINGHAM (*a*) treated a case of secondary aneurysm of the right external iliac artery, which had been tied by him a twelvemonth before, and though the sac had suppurated and filled by granulation, reappeared on the 1st of *April*. He was kept perfectly at rest in the horizontal posture, from the 3rd of that month to *May* 11, five or six ounces of blood twice taken from the arm, and tartar emetic and digitalis given. About ten days after his admission, the integuments became a little discoloured. No further change, however, occurred: and, on *May* 11, pressure on the *distal side* of the tumour was made, by means of the instrument for compressing the femoral artery in popliteal aneurysm, was commenced; but it appeared rather to increase the pulsation in the tumour." The pressure was continued at intervals, and on the next day the pad was applied to the artery at the origin of the *profunda*. The pressure was kept up the following three days, but discontinued at night; the tumour was smaller, and its pulsation diminished, but after a few days became more perceptible, and the apparatus was therefore left off." Some days subsequently, pressure was applied directly upon the tumour, by means of a compress, adhesive plaster, and bandage tightly round the body." After some days the tumour had diminished in size, and became more flat; the pressure gave no uneasiness, and was continued till the beginning of July, and on the 20th of that month, "some remains of the tumour could still be detected by pressure over its side, but no pulsation or bruit of any kind could be heard; neither can any pulsation be felt in the femoral artery, from POUPART's ligament downwards. *Aug.* 17. No tumour can now be felt; there is merely a little hardness in the situation of the former swelling." (p. 243-6.) In 1844, in another case, which was a femoral aneurysm in a man, who, fifteen months previously, had had popliteal aneurysm of the other limb cured by pressure, BELLINGHAM, after one bleeding from the arm, and fifteen drops of tincture of digitalis for five days, applied the same kind of instrument as that which had cured the disease in the other limb, at the groin, relaxing it at intervals when the pressure became painful. On the third day the instrument, having got out of order, required removal, and was temporarily replaced by a tourniquet pad at the groin, upon which a four-pound weight was placed, and this, with a slight pressure of the patient's hand, stopped the pulsation. On the following day a seven-pound weight was substituted, the tumour was somewhat more firm, and rather diminished in size; but the pulsation was still very strong when the pressure was removed. Ice was applied a day or two after to relieve the heat felt in the evening. On the eighth, a bandage was applied round the limb, from the toes over the tumour, and partly up the thigh, and the original pressure apparatus again put on; but on the twelfth day the weight was resumed, as the patient preferred it. On the nineteenth day, the pressure having been kept up steadily, except at night, whilst he sleeps, "the tumour is evidently more firm, and smaller; the patient suffers no pain when it is pressed or handled, and has lost the uneasy feeling about the limb. To-day an instrument, in form of a carpenter's clamp, was applied, the pad of which was fixed upon the artery in the upper third of the thigh, and he retained it on for several hours. However, as it compressed the femoral vein also, the limb swelled, and he was obliged to remove it towards evening." The pressure was continued on the same principle, but with an improved instrument for the following seventeen days, but the tumour continued stationary. On the thirty-sixth day a second similar instrument, "but with a larger arc, so as to permit the pad being placed over the artery in the groin, was applied, and the patient directed to use it alternately with the other upon separate portions of the vessel; and, when the pressure became painful at one point, to tighten the screw of the other, and then relax it. About three in the afternoon, he fixed the pad of one instrument on the femoral artery, where it passes over the horizontal *ramus pubis*, and the second on the femoral artery lower down, and continued the pressure nearly constantly up to twelve o'clock at night, when, on relaxing the screw, he found that the pulsation of the aneurism had ceased. He, however, persevered in the use of the instruments throughout the night." On the forty-second day, the pulsation had entirely ceased;

(*a*) Dublin Journal, vol. xxvi. 1845.

"a vessel of some size was now, for the first time, felt, which ran superficially in the course of the femoral artery, and had evidently become enlarged since the filling up of the sac of the aneurism. The patient says that last night, about twelve o'clock, when he loosened the screw of the instrument, the aneurism no longer pulsated, from which time he suffered much pain, both in the tumour and about the knee." These symptoms, however, subsided on the following day, when, "in addition to the superficial artery already mentioned in the course of the femoral, the articular arteries about the knee were found enlarged, one of which, on the inside, is nearly as large as the radial artery." On the fifty-seventh day "the tumour was about the size and shape of a small hen's egg, very firm and solid. The pulsation in the femoral artery can be traced from the groin to within a short distance of the obliterated sac of the aneurism." (p. 248–54.)

Such are the results of the first three cases, in which aneurysm has been treated by compression by the Irish Surgeons, and Bellingham has enumerated (*a*) nine other cases in which it has been employed, three of which have been managed in England by Liston, Allan, and Greatrex, and the rest in Ireland, and all cured. Thus Crampton's assertion (*b*), that "intermediate compression, or compression from without (maintained for a sufficient length of time to allow the blood in the aneurismal sac to coagulate) had been tried and was found ineffectual," (p. 359,) is proved to have been so only on account of the inefficient mode of the application of external pressure. From this account, although I have yet had no opportunity of practising this treatment, I must confess I think it highly worthy of serious attention, and am much disposed to think I should try it on a fitting occasion. Bellingham very justly observes, upon the advantage of alternating pressure upon the artery, that "the principal improvement which has taken place in the treatment of aneurism by compression, consists in the mode of applying the pressure; that is, instead of employing a single instrument, we employ two or three, if necessary; these are placed on the artery leading to the aneurismal sac; and, when the pressure of one becomes painful, it is relaxed, the other having been previously tightened, and, by thus alternating the pressure, we can keep up continued compression for any length of time. By this means the principal obstacle in the way of the employment of pressure has been removed; the patient can apply it with comparatively little inconvenience to himself; time will not be lost owing to the parts becoming painful or excoriated from the pressure of the pad of the instrument; and, as the pressure need not be interrupted for any length of time, the duration of the treatment will be necessarily considerably abridged." (p. 167.) With regard to the treatment of the artery which has been thus treated, Bellingham says:—"It will be observed, from the histories of the cases which have been published, that the femoral artery could be traced, after the cure, to near the sac of the aneurism, proving that the artery is never obliterated at the point compressed." (p. 165.) This is a very interesting circumstance, and supports John Hunter's opinion, that "the force of the circulation being taken off from the aneurismal sac, the progress of the disease would be stopped."]

1420. As regards the more precise determination of making use of pressure for the cure of aneurysm, it is advised by many to employ it in all aneurysms, so that even if no cure take place, a progressive expansion of the collateral branches may be effected. It may be employed if the aneurysm be still recent, if it be not large, especially when the consequence of an external injury; if there be no circumstances which render a speedy cure necessary; if the patient be not very stout, the limb not very much swollen, and the artery so situated, that its walls can be properly brought together by compression. Where beneficial, it soon shows; the experiment of compression is, therefore, never to be persisted in too long, and it should be left off as soon as circumstances occur which may render it dangerous. It is always proper to accompany the pressure with rest, blood-letting, cold applications to the swelling, and the internal use of digitalis, and so on.

Samuel Cooper (*c*) believes, that compression is successful only in about one out of thirty cases, and that a certain number of the successful cases must doubtless be considered rather as spontaneous cures of aneurysm.

(*a*) Med.-Chir. Trans., vol. vii.

(*b*) Dublin Journal, vol. xxvii. 1845.

(*c*) First Lines of Surgery. London, 1819. vol. i. p. 304.

1421. *Tying* the aneurysmal artery (the *Operation for aneurysm*) is the most certain mode of treatment; and there are two modes in which it is performed. The one, laid down in the ancient Greek Surgery, by PHILAGRIUS and ANTYLLUS, which consists in opening the aneurysmal sac, removing the coagulated blood, and tying the artery above and below it; the other, where the artery is laid bare and tied above the swelling, between it and the heart, upon which the swelling diminishes and disappears (1).

(1) This mode of operation is usually called the Hunterian. Although it had been previously practised by ANEL (*a*) and DESAULT (*b*), it was, however, first raised to a systematic operation by HUNTER (2). In former times, indeed, tying the brachial artery above the aneurysmal sac was performed by AËTIUS, PAULUS ÆGINETA, GUILLEMEAU, and THEVENIN; subsequently, however, even the sac itself was opened.

[(2) The operation of tying the artery at a distance from the aneurysmal sac, and where its coats are healthy, has been justly claimed by English Surgeons, for JOHN HUNTER, notwithstanding that till within a few years our French neighbours have laboriously endeavoured to show that it was merely a repetition of the operation performed by their countryman ANEL, at Rome, in January, 1710, and subsequently by DESAULT, in June, 1785. Honourable exception to this nationality is offered by DESCHAMPS' able vindication (*c*) of HUNTER's originality in reference to his operation; and within the last few years his title to it has been almost universally conceded. The circumstances, however, are so interesting in reference to this operation and its importance so great, that a short notice of the operations of ANEL and of DESAULT cannot be here misplaced.

ANEL's operation was performed on the brachial artery of a friar which had been wounded in venesection, but which did not bleed till the fifteenth day after the injury, when it was checked by the use of astringents and bandage. ANEL's account of the disease is exceedingly confused and probably he did not very well understand its true nature, for, he says:—"From the day of venesection to that of the operation, we see that three kinds of aneurysm have occurred in the same artery of the same arm," a true aneurysm, a false one, and a true one again, upon which last he operated. It is probable, however, that during the whole course of the disease it was none other than the ordinary spurious aneurysm following a wound in an artery, which, JOHN HUNTER (*d*) observes, "will produce various effects according to the treatment, all of which are called so many aneurisms: but I do not consider a wound in an artery, an aneurism, even if in an aneurism itself." (p. 543.) ANEL thus describes the operation performed on the 30th January, 1710:—"Having made myself master of the blood by means of a tourniquet, I made an incision in the integuments without touching, in any way, the aneurismal sac; I then sought for the artery, which I found situated below the nerve, which is not common. I took every precaution in separating it from this, and having lifted it upon a hook, I ligatured it *as near to the tumour as possible.* The artery having been tied I loosened the tourniquet, when a small muscular branch, which I had divided in dissecting the vessel, bled and compelled me immediately to tighten the tourniquet and to tie the artery again a little higher up; the tourniquet being loosened, I saw no more bleeding nor any pulsation in the tumour. I then applied the proper dressings and a bandage." (p. 220.) On the following day pulsation of the artery at the wrist was very distinct. "The first ligature separated on the 17th day of February, 1710; and the second on the 27th of the same month; without the supervention of the least hemorrhage, on the 1st of March in the same year, this friar not only left his room, but went even to church. * * * On the 5th of March the wound was perfectly cicatrized." (p. 221.) In his reflections on the case, ANEL observes:—"With regard to the mode of doing the operation, I performed it in a different way to what authors describe, which I have seen good Surgeons adopt, and which I have myself had recourse to several times; for instead, as is customary, of applying the ligature above and below the aneurism, I only practised it above. Besides, the aneurismal sac is usually opened, but I did not touch it at all; not doubting but that the blood contained in it would be dissipated, being at

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(*a*) Suite de la nouvelle Méthode de guérir la Fistule lachrymale. Turin, 1714, p. 257. I have copied this account from ERICHSEN's Observations, as the copy of ANEL, which I have by me, does not contain this notice.—J. F. S.

(*b*) Œuvres chirurgicales, vol. ii. pt. iv.

(*c*) Observations sur la Ligature des principales Artères des Extrémités, à la suite de leurs blessures, et dans les Anévrismes, particulièrement dans celui de l'Artère poplitée, dont deux ont été opérées, suivant la méthode de JEAN HUNTER, Chirurgien anglois. Paris, 1793; and at end of his Traité historique et dogmatique de l'Opération de la Taille, vol. iv. Paris, 1796–97.

(*d*) Lectures on the Principles of Surgery; in his Works, edited by PALMER.

liberty to pass on towards the extremity; that the sac, being once empty, would not fill again; that the layers of membrane that formed it would not fail to collapse; and that thus the tumour would disappear, all which happened as I thought. In this way the operation was less tedious, and much less painful; besides, my incision was not half the usual length, hence there was a smaller cicatrix." (p. 223.) The tumour collapsed in such a way that it would have been impossible to have ascertained the spot where the aneurism existed." (p. 222.)

Desault's operation, as stated by Sabatier (*a*), was performed in June, 1785, upon a popliteal aneurysm which "had acquired the size of a turkey-hen's egg; the patient was thirty years of age. * * * Desault made an incision about two inches in length at the upper part of the tumour, laid the artery bare, separated it from the nerve and tied it. * * * On the sixth day he tied a ligature of reserve, that he had placed under the artery above the first one. The state of the wound and of the patient was such as to promise a speedy cure." The tumour diminished to half its size and the ligature came away on the eighteenth day. "On the following day the wound discharged a tolerable large quantity of matter mixed with blood, and the tumour disappeared almost entirely; an evident sign of the rupture of the aneurismal sac. After this nothing was left but a fistulous opening which healed in a few days." (p. 403.)

Erichsen (*b*) observes:—"From the following remark by Maunoir it would appear that little importance was attached to the operation at the time even by Desault himself. 'I lived,' says Maunoir, 'two years with Desault, and I do not remember to have ever heard him speak of this operation. It had not been considered of consequence; and in general, it seemed to me, that it was quoted without being understood and after very vague reports.'" (p. 403.)

Desault's operation was also performed by Pott after Hunter had performed his new operation, in a case of femoral aneurysm of which E. Home gives a brief and not very clear account in the paper presently to be cited from; it did not, however, succeed, and amputation became necessary, at what period, however, Home does not state.

I have heard it mentioned that John Hunter was indebted to Ford, for the suggestion at least, if no more, of his mode of operating in cases of aneurysm. It is not at all improbable that Hunter's mind may have been led to the operation he afterwards practised, from his reflection on the two cases of Ford's, presently to be mentioned; but this appears to be all Ford had to do with the matter, as it is very unlikely he should not have taken notice of the subject, had he any claim to it, in the paper (*c*) he published between two and three years after Hunter's first operation; and, in fact, he utterly discourages any kind of operation. He says:—"An aneurysm of the larger vessels, when it occurs in the trunk of the body, is a disease that is usually fatal, and it is not uncommonly so when it happens in the extremities; the mode of cure in the latter case, whether by amputation of the limb or by tying the artery, being universally allowed to be hazardous. * * * The cases I now communicate to you serve to establish the fact, that in cases of aneurysm the efforts of nature alone, unassisted by art, have produced in the coats of the vessel a coalescence of its sides, firm enough to render the artery impervious to the impetus of the blood, whilst the circulation in the extremity has been amply supported by the collateral branches going off above the aneurysmal tumour." (pp. 142, 43.) The first case he met with, several years previous to publishing his paper, was a popliteal aneurysm in a chairman. "He was admitted into an hospital, and at the end of three months, when he called upon me," (again,) says Ford, "I found that the tumour had totally disappeared, and that the limb was wasted, and a little weaker than the other, but that he was capable of doing his business. Upon inquiry, I could not learn that the cure could be ascribed to any other means than to the efforts of nature, with which an horizontal position of the body, and a regular diet, might perhaps have co-operated. This man died soon after of a fever, and as the limb was not examined by dissection, and a doubt arose whether the tumour was aneurysmal or not, the circumstances of the case were not deemed strong enough to justify any inference to be made from it." (pp. 143, 44.) The next case was that of a clothes-presser, thirty-six years of age, who had "a tumour situated on the anterior and upper part of the right thigh, about three inches below Poupart's ligament. It was of the size of a turkey's egg, and had a strong pulsation." He had also, "at the same time, a swelling about the size of a pullet's egg in the ham of the other leg, in which was felt a tremulous pulsation." (p. 144.) Two months after, the swelling in the right thigh had considerably increased; and from the irritation, probably dependent on a

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(*a*) Médecine Opératoire. Paris. 1796.

(*b*) Cited at head of article.

(*c*) Cases of the Spontaneous Cure of Aneurism, with Remarks; in London Medical Journal, vol. ix. 1788.

mustard poultice having been applied, and a cordial regimen directed by an empiric to promote suppuration, he had a very severe attack of fever, which, however, by proper treatment was relieved. No operation was proposed for fear of mortification and fatal hæmorrhage. "We now examined the other leg," says Ford, "but found no traces left of the swelling I had formerly seen." Six weeks after he died with gangrene of the right thigh, without hæmorrhage. On *examination* of the left ham, "externally there was no mark left of the tumour; but upon cutting down to the vessel, we found the popliteal artery enlarged to the size of a small hazel nut. On opening the artery, both above and below this tumour, and endeavouring to pass a director and a probe, it was found to be quite impervious to the instruments, although some force was used; and upon further examination, it was found plugged up by a substance of a hard and firm consistence." (p. 148.) The last case was a femoral aneurysm, seen by Ford in September, 1785, when it "was about the size of a middle-sized China orange, and obviously increasing. The situation of it was so high up as to admit of no hope of preserving his life by removing the limb, or by tying up the artery. It was, therefore, only recommended to him to lie in bed, to keep his bowels open by gentle laxatives, and to live upon a very spare diet." (p. 149.) Among the professional people who saw this man, and by whose concurrence compression at the groin was made, but could not be persevered in on account of the severity of the pain, Hunter is mentioned; but this case could not have encouraged or induced him to perform his new operation, because "for four months (from September) those symptoms continued to prevail which usually precede a fatal termination," and it was only "at the end of six months that the man began to think the pulsation was not so strong in the swelling, and that it had ceased to increase. * * * In the month of March, (three months after Hunter had operated on his patient,) the circumference of the tumour was much lessened, and the pain had ceased; the tension was also diminished, the inflammation of the skin had given way, and was now become scabious, putting on a mottled look, and appearing in some parts brown, and in others of an orange colour. (pp. 150, 51.) For two months afterwards the tumour continued to lessen. * * * He was sent into the country, where he soon recovered his strength and the use of his limbs so much, that in three months he was able to walk several miles with a stick." After the lapse of two years, he was fully recovered; but "the thigh was two inches and a half in circumference larger than the other, and there was a hard incompressible tumour where the aneurism was, but which gave him no uneasiness." (pp. 151, 52.) From this account, it is quite clear that the second is the only case which could at all have attracted the attention of such a mind as that of Hunter, and lead to the proposal of his operation; but neither of the three seemed to have impressed Ford beyond the importance of quiet, and its adequacy to effect the natural cure of the disease; and from his review of these, as well as of the cases recited by Guattani, he infers—"1st. That nature is capable of effecting the cure of many aneurisms solely by her own efforts. 2nd. That these efforts have been successful even when counteracted by improper treatment, as in the (second) case of the popliteal aneurism (no mention, however, is made of such improper treatment in the recital of the case. J. F. S.); but that a quiet position of the limb, with an antiphlogistic regimen, contributes to the cure. 3rd. That the cure by nature is a permanent one. 4th. That the inert mass left behind is not likely to produce any mischief. 5th. That the unsuccessful event of the operation for the popliteal aneurism, does not principally depend on any particular hazard in consequence of an obstructed circulation in the ham, but upon other causes." (p. 155.)

The first notice of John Hunter's improvement in the operation for aneurysm, was given by Everard Home in the year 1786 (*a*), and in that subsequent, the dissection of the case. He also published another paper (*b*), giving the history of all the cases on which Hunter operated, together with some by other Surgeons. In the first paper Home introduces the case with the following remarks:—

"The common method of operating in cases of popliteal aneurism having, in many instances, proved unsuccessful, the operation itself has been condemned by some of our most eminent Surgeons. If we consider the cases in which it has been performed, and where the patients have died, we shall probably find that in all of them the artery had been diseased at the part enclosed by the ligature, and had either sloughed off, or had been cut through where it was tied, so that the sides of the artery, though brought together, had not remained a sufficient length of time in that situation to unite by the

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(*a*) An Account of Mr. Hunter's Method of performing the Operation for the Cure of the Popliteal Aneurism; in London Medical Journal, vol. vii. 1786, vol. viii. 1787.

(*b*) An Account of Mr. Hunter's Method of performing the Operation for the Cure of the Popliteal Aneurism, containing all the cases on which he had then operated; in Transactions of a Society for the Improvement of Med. and Chir. Knowledge, vol. i. 1793.

first intention, and the patients lost their lives from the consequent hæmorrhage. The femoral and popliteal arteries are portions of the same trunk, presenting themselves on different sides of the thigh, and are readily come at in either situation: but where the artery is passing from the one side to the other, it is more buried in the surrounding parts, and cannot be exposed without some difficulty. In performing the operation for the popliteal aneurism, especially when the tumour is large, the ligature is commonly applied on the artery at that part where it emerges from the muscles. This will be too limited a space, should it prove diseased for some way higher up; and if the artery should afterwards give way from any of the causes above mentioned, there will not be a sufficient length of vessel remaining to allow of its being again secured in the ham. To follow the artery up through the insections of the *triceps* muscle, to get at a portion of it where it is sound becomes a very disagreeable part of the operation; and to make an incision on the fore part of the thigh, to get at and secure the femoral artery, would be breaking new ground—a thing to be avoided, if possible, in all operations. From these considerations, suggested by the accident of the artery giving way, which happened several times to Mr. HUNTER, he proposed, in performing this operation, that the artery should be taken up at some distance from the diseased part, so as to diminish the risk of hæmorrhage, and admit of the artery being more readily secured, should any such accident happen. The force of the circulation being thus taken off from the aneurismal sac, the cause of the disease would, in Mr. HUNTER's opinion, be removed; and he thought it highly probable that if the parts were left to themselves the sac, with the coagulated blood contained in it, might be absorbed, and the whole of the tumour removed by the actions of the animal economy, which would consequently render any opening into the sac unnecessary." (p. 391-93.)

1422. The operation for aneurysm is generally indicated—1. If compression be not applicable. 2. When, as regards the position of the artery, it can be employed, but cannot be borne. 3. When the aneurysm, already large, threatens to burst, or has burst. 4. In spurious diffused aneurysm, when the effusion of blood is considerable. The result of the operation for aneurysm is extremely doubtful, if several aneurysms exist in the same person, if the patient be in years, or weakly, if from the size of the swelling, destruction of the bones and neighbouring parts have been produced, whereby, perhaps, the collateral branches have been closed; if the arterial coats be rigid, or in any other way changed by disease, and compression, by swathing the limb, have been too long employed. The larger the principal trunk to be tied is, the more doubtful is the *prognosis;* the assistance rendered by nature by the enlargement of the collateral circulation is, however, very remarkable, and under the most unfavourable circumstances the treatment often presents the happiest results.

[E. HOME has justly observed, "that Surgeons have laid too much stress on the necessity of large collateral branches being present, to ensure the success of this operation; this must have arisen more from their anatomical knowledge, than from observations made from practice, since we find the trunk of the femoral artery may be taken up in any part of the thigh, without producing mortification of the limb. In one patient afflicted with aneurism, whose limb Mr. HUNTER examined after his death, though there was great reason to believe that the artery had been obliterated above the great muscular branch, the limb had been very well nourished." (p. 399.)

As regards the size of an aneurysm, best suited for operation, JOHN HUNTER says:—"I wish never to see one, that can be made the subject of an operation, larger than a walnut before it is operated on." (p. 543.) Surgeons however, at present, rarely care about the size of an aneurysm, provided the skin be healthy, and there be sufficient space to apply a ligature between it and the heart, on a presumed healthy part of the artery.—J. F. S.]

1423. In the operation for aneurysm, *by opening the sac*, after the circulation into the artery is arrested by the application of a tourniquet above the aneurysmal part, the skin covering the swelling is to be divided by a cut, which must extend from above to below it; the sac of the aneurysm is to be opened in the same direction, all the blood-clot removed, and the cavity cleansed. The Surgeon then endeavours to find out the proper opening of the artery, introduces into it a probe or a female catheter, with which the artery is to be raised above the sac and separated from the surrounding parts; a ligature is then to be passed round it with Deschamps' needle (1) and tied. In this way the artery is to be isolated and tied above the swelling. (What will subsequently be said, in reference to the form of the ligature, applies here.) The cavity of the sac is then cleansed, filled lightly with lint, covered with sticking-plaster and a compress, and the whole kept in its proper place with a four-headed bandage.

(1) Deschamps' needle is the most convenient instrument for a ligature; if made of silver, it can assume every necessary curve. Weiss's and Kirby's needles are suitable for some cases of very deep-lying arteries.

As to the numerous varieties of aneurysmal needles, compare—

Arnemann, Uebersicht der berühmtesten und gebräuchlichsten Instrumente älterer und neuerer Zeit. Göttingen, 1796, p. 193.

Krombholz, Akologie, p. 391.

Holtze, De arteriarum ligatura. Berol., 1827. 4to., pl. ix.

1424. Hunter's mode of operation requires the laying bare and isolation of the artery at a suitable distance above the seat of aneurysm (1). It is here especially to be remembered, that the artery should be separated from its surrounding cellular sheath only as far as is necessary to carry around it, with Deschamps' needle, a round, but not too thick ligature, which is to be firmly tied upon the artery with two single knots (2). The ends of the thread should be laid in one or other angle of the wound, the edges of which are to be brought into close contact with sticking-plaster, in order to effect the cure, if possible, by quick union. The ligature separates, according to the size of the artery, between the eighth and sixteenth day.

I consider tying the artery with a single round ligature, by which its inner and middle coats are divided, (ascertained by the artery forming a swelling above and below the ligature, and by the ligature being heaved up by the impulse of the blood,) with the simultaneous simple treatment of the wound, as the most preferable mode of treatment (*pars.* 283, 285.) The different modifications must, however, be here mentioned, which have been proposed for the more certain attainment of a successful result.

Scarpa (*a*) holds, in opposition to Jones, (who concludes from his own experiments, that the division of the internal coat of the artery, with a single round ligature, favours the formation of a plug of blood, the adhesive inflammation, and the pouring out of plastic lymph within and without the artery,) that this result happens less frequently in men than in animals, that after-bleeding occurs the more quickly, as on the setting up of suppuration, the external coat of the artery is less capable of withstanding the impulse of the blood, and that this happens so much the earlier, as the division of the arterial coats by the ligature-thread resembles more a torn and bruised, than a cut wound. Also that the ligature-thread does not bring both the divided coats together, but only the wrinkled walls of the external. As the internal coat of the artery is very much disposed to adhesive inflammation, and plastic exudation, so a pressing together of the artery is sufficient to bring about adhesion. Upon these grounds, Scarpa prefers, to all other modes, tying the artery with a small band of waxed threads, between which and the artery, a little linen cylinder, smeared with cerate, is placed. In this mode, however, the artery must be laid bare, no further than necessary to carry the band round it, nor the cylinder be longer than a line, or thereabouts, beyond the ligature, which, for the largest artery, should be about a line. The band must not be drawn excessively, but only sufficiently tight to keep the uninjured walls in close contact. By this plan of tying, a closure of the artery is produced by the actual joining together of the touching walls of the artery. Such flattening of the artery and touching of its walls, had been previously performed with broad ligatures, with the underlaying of a piece of wood or cork (3). Deschamps (*b*), more recently Crampton (*c*), Assalini (*d*), and Köhler (*e*) have

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(*a*) Memoria sulla Legatura delle principali Arterie degli Arti; con una Appendice all' Opera sull' Aneurisma. 4to. Pavia, 1817.—Vacca Berlinghieri, A., Istoria di una Allacciatura dell' Iliaca esterna e Reflessioni sull' Allacciatura temporaria delle grandi Arterie. Pisa, 1823.

(*b*) Above cited, f. 1–4.

(*c*) In Medico-Chirurg. Trans., vol. vii. pl. v. f. 2.

(*d*) Grossi.

(*e*) Dissert. sistens quædam de Aneurysmatibus scalpelli opera curandis. Berol., 1818.

attempted to operate with peculiar arterial compresses; these metallic contrivances are, however, dangerous, and in reference to their operation on the coats of the artery, and the parts surrounding it, not comparable to the soft cylinder which adapts itself to the periphery of the artery.

Jones (*a*) advanced the opinion, that, if upon a large artery several circular ligatures be made near each other, whereby as many tears of the internal coat are produced, and the threads be immediately removed, the plastic lymph effused into the cavity of the artery is sufficient for its obliteration. Hodgson (*b*) has, by experiment, disproved this opinion. Travers (*c*) recommended, but subsequently disadvised such treatment. Cases, however, are given, in which the ligature was removed twenty-four hours (*d*), and fifty and a half hours (*e*), after tying, and the cure ensued. Scarpa also has observed, that the closure of the artery follows, if the ligature, with its subjacent linen cylinder, be removed on the third or fourth day; only in weakly persons is it necessary to leave the ligature till the sixth day. Scarpa, as well as others, have made known cases favourable to this mode of treatment. His mode of applying the ligature with a subjacent cylinder specially facilitates its removal. Scarpa uses a peculiar grooved probe, cleft in front and open, and a small knife for loosening the ligature. The proposals of Palletta and Roberts must be here mentioned; by means of a sliding thread, the tightened principal loop may be again loosened; by Giuntini, one thread is attached to a little roller, in order to draw it out after the loop is cut through; Uccelli introduces a small metal half cylinder between the linen roller and the loop (*f*). Vacca Berlinghieri (*g*) is in favour of Scarpa's mode of tying with the linen roller, but not for the removal of the ligature on the fourth day. The experiments, as regards the temporary ligature on the human subject, are not yet sufficiently numerous to decide whether it should be generally employed, or only in particular cases, perhaps in old subjects and so on. It is always to be remembered, that the removal of the roller acts as an interruption, for it is firmly pressed on the artery by the loop, clings tight to it, and cannot be removed without tearing, even after the loop has been cut through. In order to get rid of the inconvenience dependent on the threads hanging out of the wound, Lawrence (*h*) proposed tying the artery with a fine silk thread, cutting it off at the knot, and closing the wound, (for the same reason, Astley Cooper (*i*) used silk-worm gut previously moistened in warm water,) as the retained knots are either absorbed or enclosed in a cellular capsule. Many cases, however, decide against this mode of tying (*j*). Maunoir (*k*) and Abernethy (*l*), under the supposition that the tied artery retracts actively, and thereby especially produces tearing and secondary bleeding, advised the application of two ligatures, and the division of the artery between (4). The rarity of secondary bleeding after amputation, which has been considered as a reason for the preference of this mode of tying, is on more than one ground inapplicable; experience is opposed to this method of tying; besides, in many cases, it cannot be undertaken, on account of the want of space, or the deep situation of the artery. The application of the so-called reserve ligature, that is, some threads which in case of secondary bleeding may be drawn together, is not only useless, but dangerous, and therefore to be rejected.

[(1) The operation of tying the femoral artery, for popliteal aneurysm, the first upon which John Hunter (*m*) operated by his new method, Dec. 1785, was conducted in the following manner:— "A tourniquet was previously applied but not tightened, that the parts might be left as much in their natural situation as possible; and he began the operation by making an incision on the fore and inner part of the thigh, rather below its middle, which incision was continued obliquely across the lower edge of the *sartorius* muscle, and was made large to give room for the better performing of whatever might be necessary in the course of the operation; the *fascia*, which covers the artery, was then laid bare for about three inches in length, and the artery being plainly felt, a slight incision, about an inch long, was made through this *fascia* along the side of the vessel, and the *fascia* dissected off, by which means the artery was exposed. Having dis-

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(*a*) A Treatise on the Process employed by Nature in suppressing Hæmorrhage, &c., and on the use of the Ligature, &c. London, 1810. 8vo.

(*b*) Above cited, p. 228.

(*c*) Med.-Chir. Trans. vol. iv. p. 435, vol. vi. p. 632.

(*d*) The Medical and Surgical Register, consisting chiefly of cases in the New York Hospital, by J. Wates, V. Mott, A. H. Stevens. New York. 1818. p. 157-163.

(*e*) Roberts, W.; in Med.-Chir. Trans., vol. xi. pt. i. p. 100.

(*f*) Lettera dell' Prof. Scarpa al Dottori Omodei sulla Legatura temporaria delle grosse Arterie degli Arti. Milano, 1823.

(*g*) Seiler's Sammlung von Abhandlungen, u. s. w.—Seiler has made some experiments, and is favourable to Scarpa's temporary Ligature. Ib., p. 156.

(*h*) Med.-Chir. Trans., vol. viii. p. 490.

(*i*) Surgical Essays, part i. p. 126.

(*j*) Cross; in London Medical Repository, vol. vii p. 363.—Cooper, A., Lectures on Surgery, vol. ii. p. 57.

(*k*) Dissert. sur la Section de l'Artère entre deux Ligatures dans l'opération de l'Anevrisme. Paris, an xiii.

(*l*) Surgical Works, vol. i. p. 151.

(*m*) London Medical Journal, vol. vii.

engaged the artery from its lateral connections by the knife, and from the parts behind it by means of the end of a thin spatula, a double ligature passed behind it by means of an eyed probe, and the artery tied, by both portions of the ligature, but so slightly as only to compress its sides together; a similar application of ligature was made a little lower; and the reason for passing four ligatures was to compress such a length of artery as might make up for the want of tightness, as he chose to avoid great pressure on the vessel at any one part. The ends of the ligature were carried directly out at the wound, the sides of which were now brought together and supported by sticking-plaster and a linen roller, that they might unite by the first intention. * * * The fourth day, on the removal of the dressings, the edges of the wound were found united through its whole length, excepting where prevented by the ligatures. * * * On the ninth day after the operation there was a considerable discharge of blood from the part where the ligatures passed out; a tourniquet was therefore applied on the artery above, which stopped the bleeding; and although the tourniquet was taken off a few hours after, no blood followed. The head of a roller was now placed upon the wound, in the direction of the artery, and over that the tourniquet, which was not tightened more than was thought sufficient to take off the impetus of the blood in that portion of the artery. * * * On the fifteenth day some of the ligatures came away, followed by a small discharge of matter, and the tumour in the ham was lessened. * * * About the latter end of January, 1786, six weeks after the operation, the patient went out of the hospital, the tumour at that time being somewhat lessened, and rather firmer to the feel. He was ordered to make some degree of pressure, by applying a compress and bandage, with a view to excite the absorbents to action. * * * March the eighth, the wound which had cicatrized, broke out again, and the patient was taken into the hospital. About the eighth of April, some remaining threads of the ligature came away, and an inflammation appeared upon the upper part of the thigh. In the middle of May a small abscess broke at some distance from the old cicatrix, at which opening some matter was discharged, but no pieces of ligature were observed. Several small threads were, at different times, discharged at the old sores, and the swelling subsided; but the thigh soon swelled again to a greater size than before, attended with considerable pain. In the beginning of July a piece of ligature, about an inch in length, came away, after which the swelling subsided entirely, and he left the hospital the eighth day of July, at which time there remained no tumour in the ham, and he was in every respect well." (p. 394–98.) Among the few remarks which E. Home makes on this case, he says:—"Mr. Hunter now rather disapproves the application of a number of ligatures, in the manner practised in the above case, as these cannot come away without producing ulceration of the artery which they enclose, a tedious process when the ligature is not drawn tight; neither do I believe he would be again inclined to heal up the wound by the first intention, but rather to allow the cut surface to inflame and suppurate, by which he would have it more in his power to come at the artery, should that prove necessary; and probably, by means of the dressings, he might make a gentle compression to assist the ligatures." (p. 399.)

Birch (*a*), of St. Thomas's Hospital, performed, I believe, the second operation after Hunter's mode, in a case of femoral aneurism, resulting from a blow. "On examination I found," says he, "a large tumour extending within two inches of Poupart's ligament upwards, and occupying two-thirds of the thigh; a pulsation could be felt, and there was no doubt of the disease being an aneurism of the femoral artery. * * * On Friday the third of November, (1786,) it was determined to perform the operation. Mr. Cline undertook to compress the artery as it passed through Poupart's ligament, which he easily effected with a hard compress in the shape of a T with a broad basis. It was agreed previous to the operation, that an incision should be carried in a semicircular form round the upper part of the aneurismal sac, in order to make room for the longitudinal incision necessary to dissect down to the artery. This was accordingly done; and the integuments raised, so as to make room to feel for the pulsation of the artery. Some portion of cellular membrane and some lymphatic glands, were necessarily dissected and removed with my fingers. I then separated the muscular fibres, and tore away the connecting parts, till the artery could be plainly felt in pulsation. It was then necessary to divide a part of the *fascia* covering the artery, which was done by carrying the back of the knife on Mr. Cline's nail, while his finger pressed upon the naked artery, after which the finger and thumb could surround and compress the vessel. An eye probe, armed with a strong flat ligature, was then pressed through the cellular membrane and carried under the artery. This being effected, we had such command of the vessel as to be able to strip it downward and pass another ligature

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(*a*) London Medical Journal, vol. vii.; in Home's paper just quoted.

somewhat lower. This last ligature was then tied, the first being left loose to secure us against accident. The threads being separated and secured, the wound was lightly dressed, the tumour left in its natural situation, and the patient put to bed with the loss of only four or five ounces of blood during the operation. No pulsation could be perceived in the tumour after the ligature was tied." (p. 401–403.) He went on well till the seventh day, when it is stated "the tumour grew thinner at one point and seemed as if disposed to ulcerate the integuments. On the evening of the eighth day he became feverish." On the tenth day "the tumour was very thin in one part, and a fluctuation evidently to be felt. The limb was warm and movable, but the patient was feverish and delirious at night." In this state he continued till the twelfth day, when he became sensible. "The tumour burst and discharged serum and grumous blood; he fainted; the dressings were not disturbed; he slept composedly; fainted again about six o'clock in the evening, and expired." (pp. 404, 405.) The examination after death, in this case, showed "the blood in the tumour very putrid, and the greater part of it fluid; it appeared to be dissolved by putrefaction. Water injected by the external iliac artery escaped freely from the wound at the ligature, where the artery was open, and appeared to have ulcerated at that part. In dilating the artery from the ligature to the heart, its internal surface appeared of a bright red. This appearance lessened at the curvature of the *aorta*, yet it was very evident in its semilunar valves. The *arteria profunda*, which passed off from the femoral artery rather less than half an inch above the ligature, was also inflamed within." There were nearly two inches of the femoral artery between the ligature and the aneurismal sac. (pp. 405, 6.) It may be here added, on Sir ASTLEY COOPER's authority, that the femoral artery in the space between the ligature and the *profunda* contained no clot, which he considered to have depended on the nearness of the latter artery to the ligature having prevented the formation of an internal clot, by the continuous flow of blood into that vessel. I am, however, by no means sure that this was really the case; it is very true that in the preparation which is in St. Thomas's Museum no clot is apparent, as the femoral artery is slit upwards from the ligature to its full extent; but it seems very probable that by the injection of the water that a clot might easily have been disturbed, and when the vessel was laid open that it might have dropped out unnoticed, as at the time of this case, such a circumstance was not much thought of.

(2) The importance of opening the sheath to the least possible extent, which its complete isolation and the application of the ligature, will admit, cannot be too strongly impressed. Nor less important is doing this with the least possible disturbance of the position of the vessel, which ought never to be lifted up nor dragged, as too frequently done. I think it is best after opening the sheath, to separate the artery gently with the director previous to passing the aneurysmal needle behind it. Some persons prefer DESCHAMPS' needle, the curve of which will be found to require adaptation corresponding with the depth and situation of the artery. Others prefer a blunt-pointed flexible silver needle without a handle, for the introduction of the ligature. I do not think it of much consequence which is employed; it is the dexterity and knowledge of the Surgeon, not the instrument that he employs, upon which the proper performance of the operation depends. Especial care should also be taken that no nerve be included in the ligature; and if the patient should express great pain at the time the thread is first tightened, there is good reason to believe this has been done, and it will be necessary to make a careful examination, and even loosen the knot, to be sure of the perfect isolation of the artery, otherwise dangerous symptoms will ensue. The size of the ligature should accord with that of the artery to be tied. As to the material, ASTLEY COOPER was accustomed to use Dutch twine, but round strong silk is generally employed, and its strength tested before it is applied, or it may break upon the artery in tying, an accident which I have witnessed more than once or twice. The artery should not be lifted up from its bed in making the knots, but the ends of the forefingers or thumbs carried down the wound to it, and then the tie made. Nor do I believe it needful to draw the silk so exceedingly tight as commonly recommended for the purpose, as it is said, of cutting through the internal coat; it should be drawn so much, that the whole of the internal coat be brought into close contact, and that the silk should indent the external coat of the vessel; in other words, the ligature should be tied moderately tight. I do not believe that cutting through the internal coat is absosolutely necessary for the safe application of a ligature. A thread applied around the carotid artery of a dog so loose as not to interfere with the passage of the blood, is sufficient to cause inflammation, which will block it up completely, as was proved by an experiment made by my able master, the younger CLINE, and which I myself have repeated with the like result.

(3) In the Museum of St. Thomas's Hospital there are two preparations, in which the femoral artery was tied with a broad tape and removed after some hours by the elder CLINE (*a*), in cases of popliteal aneurysm. In one case, the artery being laid bare, a double tape, about an inch broad, and one piece lying over the other, was passed by means of an instrument behind the artery. The piece of tin which conducted the tape was cut off, and a cork nearly an inch long was laid upon the artery and confined to its situation by means of the upper tape, producing in this way, a sufficient pressure upon the vessel included between the ligature and cork to stop the circulation, and, consequently, the pulsation of the tumour in the ham. The other portion of tape was left loose. The intention of securing the artery in this way was, to compress the sides of the vessel together, and produce union without ulceration. On the ninth day the tapes were removed, and every thing seemed to be going on very favourably when the patient was attacked by a fever, supposed to have been caught from another patient in the same ward, of which he died on the seventeenth day after the operation. On *examination* of the limb after death, it was found that ulceration had taken place, though the whole extent of the artery included in the tape and sinuses were formed both upwards and downwards in the course of the thigh to some distance. In the other case, similarly treated, the operation was successful, but the patient died three months after, of diseased lungs. Both these preparations are in the Museum at St. Thomas's Hospital.

CRAMPTON (now Sir PHILIP), of Dublin, holding (*b*) that the division of the internal and middle coats is precisely the kind of injury which a diseased artery is least able to bear with impunity; and that, "accordingly, secondary hæmorrhage, or even aneurism, is not an unfrequent consequence of this operation," (p. 358,) adopted a modification of CLINE's use of a temporary ligature. "The femoral artery was laid bare, at the usual place, by an incision not exceeding three inches in length, and a tape one-eighth of an inch in breadth, was passed under it by means of an aneurism-needle. The ends of the ligature were passed through the holes in the foot of the *presse-artère*, and then crossed through the hole in its stalk. The artery was gently compressed by drawing the two ends of the ligature in an opposite direction, until the pulsation had ceased. The ligature was then secured by passing a small peg of wood through the hole in its stalk." Soon after he had excruciating pain in the calf of his leg, and this continuing, at the end of two hours CRAMPTON "determined to relax the ligature, as well to ascertain how far the pain was excited by its pressure, as to observe what progress had been made in the process of coagulation; the peg was withdrawn from the hole in the stalk of the instrument, and the ligature was thus left at liberty to yield to any impulse that it might receive from the artery. I watched for five minutes, with my hand upon the tumour, and as the pulsation did not recur, the peg was replaced, so as to secure the ligature at the degree of tension it now possessed." After forty-four hours, the ligature was completely relaxed; there was no pulsation in the ham; and on the following day it was removed, and the patient cured. (p. 365–68.) DEASE, of Dublin, also performed the same operation, and loosened the ligature five hours after; but a minute after, "a deep and obscure pulsation was discerned in the tumour, which became more distinct every moment. The ligature was immediately tightened and the pulsation ceased. Nineteen hours after, "the ligature was again completely loosened: we waited with great anxiety for nearly an hour, but the pulsation returned no more." (p. 369.) The patient recovered. CRAMPTON's instrument consists of a short cylinder, having a foot at bottom pierced on either side with a hole for the tape, which having been passed round the artery, has its ends brought up through these holes and then passed through a transverse hole near the top of the cylinder, where they are crossed and tied; a little screw works down upon this tie, by which the ligature can be tightened.

LISFRANC (*c*) says:—"If an artery be of a yellow colour, it is diseased; its sheath must not then be opened, but must be tied with the vessel; he has often seen DUPUYTREN follow this excellent practice with success." (p. 282.)

He prefers opening the sheath with his nail, rather than by raising it with forceps and cutting it with a knife, or opening it with a director." (p. 282.)]

(4) The application of two ligatures, and the division of the artery between them, as recommended by ABERNETHY, is now very rarely adopted, and a single ligature is certainly preferable; yet I cannot think with ABERNETHY, that his operation is advisable as safest, when the experience of the Surgeon who operates is not large. "Though

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(*a*) In HOME's Account of HUNTER's operation, above quoted. Trans. Med. and Chir. vol. i. p. 174.

(*b*) An Account of a new Method of operating for the Cure of External Aneurism, with some observations and experiments, &c.; in Med.-Chir. Trans. vol. vii.

(*c*) Clinique Chirurgicale, vol. i.

an experienced and skilful operator," says he, "may accomplish this object with very little disturbance of the artery, from its natural situation and connections; yet I cannot but suspect that Surgeons in general may not be so successful, especially in cases where, from the deep situation of the vessel, the surrounding it with a ligature depends more on feeling than on sight." (p. 248.)

It does not appear whether ABERNETHY originally proposed the division of the artery between the ligatures, to admit the retraction of its ends, or whether he was aware of GALEN's advice (*a*) on this point, which was to the same effect. "If the artery be large," says GALEN, "and if it can be cicatrized beyond the aneurysm, the whole of it should be cut through, and oftentimes that very practice prevents the danger from hæmorrhage; for it appears plainly that when a complete transverse division is made, both portions of the artery retract on either side, the one above the part and the other below it."

1425. After the performance of the operation for aneurysm, the limb is to be put into such position, that the artery be not stretched; the patient should be kept in the most perfect bodily and mental quiet, should be surrounded with well-advised assistants, and treated according as inflammatory or spasmodic symptoms occur. After the operation of opening the sac, the dressing is to be renewed every third or fourth day; when the ligatures separate, and the wound is filled with granulations, its edges are to be brought together with sticking plaster. After the HUNTERIAN operation, the wound is to be treated as one which is to be cured by quick union. In these modes of treatment, immediately after the artery is tied, the pulsation in the aneurysmal sac ceases, the swelling gradually becomes smaller, and at last completely disappears. The pulsation, however, shows itself anew, and often very quickly, in consequence of which, the Surgeon may fall into error, if he suppose that it results from relaxation of the ligature. The pulsation is rather a proof that the ligature is well applied, and that the blood again passes into the aneurysmal sac by the collateral branches. It is of uncertain duration, and there is generally no fear of enlargement of the sac, which slowly lessens. It must, however, be remembered, after HUNTER's operation, in aneurysm at the bend of the arm, upon the back and palm of the hand, and foot, that in consequence of the numerous anastomoses the blood can again distend the aneurysmal sac (*b*). The pulsation which recurs in an aneurysmal sac, after HUNTER's operation, depends either on the flowing of the blood into that part of the artery between the seat of ligature and the sac, or on the collateral branches which open into the sac, or on the regurgitation of the blood into the sac from the artery below it (1).

WEDEMEIER (*c*) has communicated a case, in which, after tying the femoral artery for popliteal aneurysm, the sac burst in the ham, and bleeding ensued, which rendered amputation necessary.

[(1) GUTHRIE mentions, that "it is not uncommon for a pulsation to be felt in the tumour a few hours, or in a day or two after the operation from this very cause, (the large size and direct communication of the collateral branches with the artery below the ligature,) but it very rarely continues." (p. 153.) I do not think this so common as just stated, for I do not recollect to have noticed it above two or three times. But I do not think that the absence of perceptible pulsation is a positive proof that no blood gets into the aneurysmal sac after the artery has been tied, as most probably it does for a time; and the distinctness of the pulsation depends merely on the quantity which flows into the sac.

In a case of popliteal aneurysm, for which I tied the femoral artery on Sept. 12, 1840, pulsation was thought to be felt in the sac twenty-four hours after the operation, but I could not satisfy myself that it really existed till the third day. After this, it continued to pulsate feebly, but distinctly, for about two months, when its pulsation again in-

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(*a*) Περι φλεβοτομιας θεραπευτικον, chap. 23, vol. xi. p. 313. KUHN's Edit.

(*b*) SCARPA, above cited.—WEDEMEIER; in LANGENBECK's neuer Bibl. für Chir. u. Ophthalm., vol. ii. p. 560.

(*c*) RUST's Magazin für die gesammte Heilk., vol. vi. p. 220.

creased a little; and under this condition he left the house at the latter end of December. But the most remarkable instance with which I am acquainted was a case of carotid aneurysm as large as a walnut, for which my friend GREEN tied the right carotid artery in April, 1831. The pulsation did not immediately cease on the application of the ligature, but it did in the course of the following hour; on the following day, however, it recurred feebly, and continued, though diminishing, till the seventeenth day, but it never ceased. The ligature came away on the thirty-fourth day, and on the forty-seventh the pulsation was again distinct, though feeble. In the course of the following fortnight the sac increased in size, and the pulsation increased correspondently with it. GREEN thought the aneurysm was situated at the bifurcation of the carotid, and that the pulsation was kept up by regurgitation from the internal carotid. It was a curious circumstance, in reference to this case, that the jugular vein of the same side, on the day following the operation, began to pulsate, and continued to do so frequently though not constantly. The patient had also an aneurysm in the other carotid. Perhaps the preparation in the College Museum of an aneurysm of the carotid artery just before its division, and nearly filled with clot except at the upper part, towards which the current of blood has been directed, may correspond with GREEN's case.—J. F. S.]

1426. Two circumstances are specially to be dreaded after the operation for aneurysm, to wit, *Bleeding* and *Mortification* of the limb.

1427. *Bleeding* is the more to be dreaded; the larger the arterial trunk which has been tied, the nearer the ligature lies to a large collateral branch, or if the tied artery be in a state of chronic inflammation, or otherwise changed by disease. The bleeding generally occurs between the fourth and fifth days, but in many cases later. As soon as it takes place, the artery must be compressed above and below the bleeding part, and if the bleeding be not thereby stopped, the wound must be carefully examined, and the artery taken up afresh. After the operation by opening of the sac, the bleeding may take place from the upper or lower end of the artery, or from collateral branches opening into the sac.

[In HUNTER's first case (*a*), "on the ninth day after the operation there was a considerable discharge of blood from the part where the ligatures passed out," (p. 150,) but it was stopped by pressure with a tourniquet, and did not recur. In his second case, in which the wound was made to unite by granulation instead of quick union, "on the nineteenth day there was an hæmorrhage from behind the muscle, the swelling of which rendered it nearly as difficult to come at the vessel as if the parts had healed by the first intention; the bleeding was stopped by applying pressure, after having lost about 10 or 12 ounces. On the twentieth there was a slight bleeding which was readily stopped, yet five hours afterwards the femoral artery gave way, and he lost about one pound of blood before the tourniquet was applied. The artery was laid bare and tied a little higher up, the patient being very weak and low; in this state he continued till the twenty-third day without bleeding, when it bled again from a small vessel. On the twenty-sixth a considerable hæmorrhage having taken place, he became faint, then delirious, had vomiting with hiccough, and died the same day." (pp. 159, 60.) No bleeding occurred in HUNTER's other three cases.

One of the most interesting and anxious cases of after-bleeding happened under my colleague GREEN's care in 1825, in a case of axillary aneurysm, for which he tied the subclavian artery external to the scalene muscles, on the 2nd of August of that year. Nothing peculiar occurred at the operation. He suffered a good deal from constitutional excitement, which, however, subsided. On the afternoon of the 14th there was a sudden bleeding in a jet of five or six inches, and he lost very quickly, it was believed, more than a pint of blood; it ceased, however, by firm pressure with a wadding of tow kept up for 10 or 15 minutes, after which all the dressings were removed and linen dipped in cold water, and replaced every 10 minutes, was laid over the wound. On the following day pulsation in the wound was observed, but it almost entirely ceased two days after, and on the 26th the wound was healed, all but the middle. The ligature came away on the 29th, that is, 27 days after the operation. Oct. 31. A small sinus still continues open, from which there has been a slight discharge. About midnight, while he slept, a gush of blood occurred from the wound, which was readily stopped by pressure. It was attended with very great pain in his

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(*a*) Trans. Med. and Chir., vol. i. above quoted.

arm. On the following evening bleeding recurred as he was making water; the blood, which was arterial, rose in a jet five or six inches, and was in as large a stream as the wound would permit; it was easily stopped by pressure for an hour and then cold wet rag applied. There was no further recurrence of bleeding, and he recovered. On the 12th of December pulsation was felt in the radial artery. After this time nothing of importance occurred, and he got well.

From this case and from two or three others I have seen, I think it must be inferred that when bleeding occurs at the wound after the application of a ligature, it is advisable to do as little as possible, unless the bleeding be so great that the patient's life is in immediate danger. Even the continuance of pressure after the blood ceases to flow had better be left alone, as I have already mentioned, in the treatment of some wounded arteries. The strictest quietude, and the application of cold evaporating washes, should be trusted to, and will be oftentimes successful. But the application of a ligature higher up must be always undertaken with great fear of the result, as generally the cause of want of union at the first placed ligature being a diseased state of the artery, it may be justly dreaded that the vessel may be similarly affected still higher up, and that the same consequences will ensue when the ligature begins to separate. I am inclined to think that if the bleeding be so severe as not to admit delay, I should amputate the limb, not that the actual state of the artery would be other than if it were simply tied; but there would be the advantage, if bleeding recurred, of having the opportunity to apply the actual cautery more efficiently than could be otherwise done; and as this practice is very successful, when, after amputation under ordinary circumstances, the sealing up of the artery has not happened, and either without or with its extremity assuming an aneurysmal character, repeated after-bleedings occur, so I think the actual cautery might be applied successfully to a diseased artery in aneurysm.—J. F. S.

In connexion with this subject may be here mentioned the occasional, though rare recurrence of aneurysm, in a sac which had disappeared after tying the artery above it. Two instances of this kind are mentioned by GUTHRIE (*a*). The first a popliteal aneurysm, for which the femoral artery was tied by GUNNING, of St. George's Hospital, on 27*th April*, 1821, and the patient dismissed cured on the 30*th June* following. On the 20*th July*, 1825, he was readmitted under JEFFREYS, stating that the swelling had entirely disappeared soon after he left the hospital in 1821; but that six weeks since he had noticed its return, of the size of a hen's egg, in the upper part of the ham. "The tumour (on his return) occupied the lower third of the thigh, filling up the whole of the popliteal space, and projecting considerably on each side of the limb, between the hamstrings and the exterior muscles situated on the forepart of the thigh. It appeared to consist of three lobes, and was altogether as big as an ostrich egg. The pulsation in it was feeble but distinct, the skin covering it of its natural colour, and he did not complain of much pain." (p. 155.) He would not submit to having the artery tied, but determined on amputation, which, however, was deferred in consequence of violent salivation from taking a scruple of rhubarb and five grains of calomel, till 5*th September*, when the limb was removed "between the tumour and the part where the femoral artery had been tied. A large vessel, which appeared to be the femoral artery, and eight smaller ones, were tied;" but he became faint and sick during the dressing of the stump, and eight hours after died. On *examination*, "the femoral artery was found to be obliterated, for the space of half an inch, at the part where the ligature had been applied four years ago, and immediately below it two small branches were observed to enter the continued trunk of that vessel, These branches were equal to half the diameter of the femoral artery. The anastomosing branches, given off above the obliterated portion, were a good deal enlarged." (pp. 155, 56.) The second case was also a popliteal aneurysm, for which the femoral artery was tied by BRIGGS, 6*th March*, 1829. "The pulsation in the tumour ceased, and it diminished very much in size. It was only in *June* he was able to go to work, when the swelling had entirely disappeared. In *September* it began to appear again with pulsation, both the swelling and pulsation being soon greater than before." Compression of the leg and swelling was employed, but could not be borne. "A hard compress, in fact a narrow roller four inches in length, was applied on the inside of the thigh, just above the knee and above the inner hamstring muscles, which was firmly retained in that situation night and day. This gave him relief by taking away the pain, which was principally felt in the toes and ankle. This compress he wore for two months, at the end of which time the pulsation had ceased, although the swelling had not entirely subsided." (p. 159.) A year after there was no appearance of a swelling.]

1428. *Mortification of the Limb*, after tying the principal trunk of an

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(*a*) Cited at head of Article.

artery, depends on the impossibility of properly sustaining the circulation in the limb by the collateral branches, and by the anastomoses of the capillary-vascular system. Perhaps such unyielding condition of the collateral vessels as does not admit properly the restoration of the circulation, is also a principal cause of secondary hæmorrhage, inasmuch as the blood is driven with so much more force against the seat of the ligature, and thereby tearing of the artery is easily produced. The circulation is most easily restored in young subjects, and with a certain energy of circulation. After tying the principal artery of a limb, if it be even ultimately well nourished, the limb is always more or less numb, insensible, and has its natural warmth diminished. In proportion as these symptoms are slighter, there is greater hope that the circulation will soon be restored. It is endeavoured to promote the circulation with warm flannel, or warm bags filled with sand or aromatic herbs so applied that the limb is not at all pressed, and renewed as often as they begin to cool. Subsequently warm applications of spirituous or aromatic fluids are to be used. After some days usually sensation and warmth recur, the latter often to a high degree, and continues, although the limb be not enveloped in warm bags or overlays. It is not uncommon that, although subsequently the circulation recur properly, the extreme parts of the limb, to wit, several of the toes, mortify. If, after persisting for several days in the use of the above-mentioned remedies, and of careful rubbing, the sensation and warmth do not return, there is the greatest danger of the limb mortifying. It then swells considerably, becomes bluish, and if the patient do not die in consequence, amputation is the only remaining remedy, but it rarely has a favourable issue.

[Sometimes, although the operation go on favourably, and the ligature-wound heal, yet the aneurysmal sac will burst and discharge its contents; this happened in JOHN HUNTER's third operation (*a*), four weeks after the operation, "but it healed up like any other sore, and at the end of three months he was perfectly recovered." (p. 161.)]

1429. As regards the preference of the old, or of the HUNTERIAN operation, it may be assumed generally of the former—*first*, that on account of the usually deep situation of the artery, and of the nerves and veins connected with it, which parts have changed their natural place, it is always extremely complicated, difficult, and excites considerable injury, especially as the sac is generally in the neighbourhood of a joint; *second*, that if the aneurysm be consequent on an inflammatory, ulcerative, or otherwise diseased condition of the artery, the ligature, although applied both above and below the sac, may be placed on some part of the artery where the walls are not disposed to adhesive inflammation; *third*, that in this operation there is always a considerable quantity of blood lost; *fourth*, that on account of the large and deep wound in the neighbourhood of the joint, *anchylosis* commonly remains, and, *fifth*, that after-bleeding is frequent after opening the sac. On the other hand, by this operation all the coagulated blood is removed from the sac, which, after the HUNTERIAN operation, if not absorbed, in rare cases produces inflammation, suppuration, and bursting of the sac.

1430. The advantages of HUNTER's mode of operation are in general much greater than those of the old; for therein the place for applying the ligature may be selected, and probably upon a part of the artery which is best suited for adhesive inflammation; the operation itself is accom-

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(*a*) HOME's account, above cited; in Trans. Med. and Chir., vol. i.

panied with much less difficulty and pain; after-bleeding is more rare; the patient can use his limb as well after as previous to the operation; experience speaks in favour of Hunter's mode of operation. Finally, in many cases where, on account of the seat of the aneurysm being near the trunk, the opening of the sac is not possible, this operation is alone admissible

1431. Important, however, as is the superiority of Hunter's over the old operation, so that by many Surgeons it is considered unconditionally as the best mode of operating, yet after what has been already said about the accidents after the operation, the opening of the sac must be conceded if the aneurysm be diffused, and accompanied with much extravasation of blood, and in aneurysm at the bend of the arm (1), on the back and front of the hand and foot. (*par.* 1425.)

(1) Scarpa, Walther, and others, consider two ligatures in circumscribed aneurysm at the bend of the arm, as a superfluous proceeding. Compare, on the contrary, the cases given by Wedemeier (*a*).

The opening of the sac has also been considered preferable to Hunter's operation, in those cases in which the aneurysmal sac is very large, and its absorption not to be expected; experience, however, shows that even the largest sacs will gradually diminish.

1432. The proposal of *torsion* of the artery in its continuity by means of a Deschamps' needle (1), Amussat's (2) division and thrusting back of the internal coats of the artery, (*réfoulement de la membrane interne, et moyenne de l'artère,*) and Tavignot's subcutaneous tying of the superficial arteries, must be here noticed.

(1) Thierry (*b*) and, subsequently, Lieber have proposed torsion or twisting the arterial tube, instead of tying it, for the cure of aneurysm; and this mode of obliterating the vessel has been practised by them on a living animal. The artery having been exposed, a Deschamp's needle is passed beneath so as to raise it, and then, by means of a stick, a twisting is produced, (without, however, opening the vessel,) proportioning the number of turns to the size of the artery; the wound is then closed, and having nothing extraneous in it, the obliteration is as complete as if it were tied with a ligature. Bérard (*c*) properly objects to this practice, that if the artery be healthy, there is no fear of the ligature causing bleeding by prematurely cutting through it; but if the artery be unhealthy and friable, the twisting will at once cause tearing of its coats.

(2) The thrusting back of the arterial coats with forceps was the result of experiments performed by Caron du Villars, and repeated by Amussat.

In Amussat's *division and thrusting back the internal coats* (*d*), the artery is laid bare by a pretty large cut, as in the ordinary mode of operation, and isolated for some lines. The artery is then seized transversely by the right hand with a pair of torsion forceps, the branches of which, when closed, touch very exactly, so that the vessel lies directly between its branches; a second pair of forceps is then applied with the left hand on the opposite side, at the distance of some lines, also transversely. The vessel is so held with the two pairs of forceps, that the forceps can be laid parallel, and not at an acute angle, and then pretty strongly pressed together. By these means the inner and middle coats of the artery are torn, and only, in the interspace between the two pairs of forceps, remains a ring consisting of all three coats of the artery. The thrusting back of the internal coats is next effected solely by the forceps farthest from the heart, because this, according to Amussat's experience, is sufficient; and the

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(*a*) Above cited.

(*b*) Thierry, De la Torsion des Artères. Paris, 1829.—Froriep's chirurg. Kupfertaf., pl.ccxxxiii.

(*c*) Dictionnaire de Médecine, ou Répertoire générale des Sciences Médicales—article, *Anévrysmes*, vol. iii. p. 49.

(*d*) Petit Aperçu critique sur quelques Procédes récemment imaginés pour obtenir l'Oblitération des Artères, sans avoir recours à la Ligature. Paris, 1831.—Mitscherlich, C., Ueber Amussat's Methode für die Operation der Pulsadergeschwülste; in Rust's Magazin.

thrusting back of the coats upwards towards the heart is difficult of performance and insufficient. The forceps destined for the thrusting back are supported sometimes by the point, sometimes by the opposite end, on the fixed forceps, and so acting alternately and like a lever, they thrust back the internal coats, first on the one, then on the other side, by which all tearing of the artery is prevented. When the operation is thus completed, the wound is to be closed, and the cure attempted by quick union. Amussat has published numerous experiments on brutes, and the operation also on man, with successful result.

According to Tavignot's plan (*a*), the two ends, laid together, of a silk thread are to be passed through the eye of one small and one large curved needle, and the loop allowed to hang loosely. The smaller needle is to be carried over the artery, the larger one is to take a directly opposite direction to it, is to pass through the hole made by the former, away under the artery, and carried out again at the same hole. From the opening of each needle-track the loop of one and the two ends of the other thread hang down; the one is then pushed through the other; another coloured thin silk thread is passed through each of the loops (so that the loops may, when needful, be again loosened); the two ends are then pulled, by which the loops are drawn together. The ends are fastened to a horseshoe-like instrument.

On examination of arteries which have been subjected to this operation, the following changes are found. At the part where the forceps next the heart was applied the external coat only remained entire; then followed a ring about a line broad, consisting of all the coats of the artery; beneath this again, the internal coats were divided, and thrust back under the cellular coat, to the extent of two or more lines. At this part which externally felt hard, the area of the artery was considerably diminished by the thrust back and inverted coats, and subsequently still more so by the ensuing swelling and effusion, whereby the complete obliteration was effected.

The various remedies which have been proposed for the treatment of aneurysm, or which have been made use of, are still to be mentioned in historical review.

1. *Cutting into and plugging the aneurysm.* 2. *Suture of arterial wounds*, with a needle and thread wound round it. Lambert effected obliteration of the artery by this practice in man, and Amussat in brutes. 3. *Application of a ligature with a running knot*, for the purpose of *gradually* compressing the vessel. (Dubois, Larrey.) 4. *Acupuncture;* E. Home (*b*) thrust a needle into an iliac aneurysm, heated it with the flame of a spirit lamp, and allowed it to remain twenty or thirty minutes. The soft and, notwithstanding its previous tying, still pulsatory swelling, gradually became harder, lost its pulsation, and the needle exhibited hardened clot every time it was drawn out. Velpeau (*c*) proposes the introduction of a needle into the artery when laid bare, in which it is to remain for at least four days. One needle is sufficient for an artery as large as a feather; two or three are necessary for larger arteries. The same result is effected by means of a thread carried round the artery, and tied on a little pad. According to Phillips (*d*), the thrusting in of several needles into the aneurysmal sac, or the introduction of a silver thread; in sixty hours inflammation ensued, after which the sac shrunk as in Hunter's operation. Pravaz has proposed to use galvanism, with needles thrust into the sac, in order to excite more quickly the coagulation of the blood. Leroy d'Etiolles (*e*) applied the extremities of two compressors, at the distance of some inches from each other, for the purpose of coagulating the blood in the interspace between them; he also applied ice on the part, and used acupuncture and galvanism. 5. *Cauterization* with moxas (Larrey). 6. The *introduction of mechanical plugs* of wax and so on into the arteries, and the compression of the ends of the artery or ligatures. 7. The *introduction of threads* into the artery (Jameson, Worms, Amussat.) 8. Various modes of *compressing the artery* between the rounded branches of forceps, and tying it below this part, according to Amussat's experiments on brutes.

(*a*) De la Ligature sous-cutanée des Artères; in Examinateur Médical, 13–20. Feb. 1842.

(*b*) Phil. Trans., 1826.

(*c*) Révue Médicale, Jan. 1831. p. 137. Médecine opératoire. Nouv. Edit., vol. ii. p. 66.

(*d*) London Med. Gaz., vol. xxvi. p. 134. 1840.

(*e*) Lancette Française, March, 1835.

Compare, **Lisfranc**, Des diverses Méthodes et des différens Procédés pour l'Oblitération des Artères dans le Traitement des Anévrismes; de leurs avantages et de leurs inconvéniens respectifs. Paris, 1834.

1433. In aneurysms in which tying the artery between the swelling and the heart is impossible, **Desault** (*a*) and **Brasdor** have proposed laying bare that side of the swelling farthest from the heart and tying it, for the purpose of effecting obliteration of the artery up to the nearest collateral branches, by the stagnation of the blood in the aneurysmal sac. **Deschamps** (*b*) followed out this proposal with unsatisfactory result; so also **Astley Cooper** (*c*). From these cases it has been improperly determined to reject this practice unconditionally (*d*), as it can only answer our expectations *if no branches arise from the artery between the seat of ligature and the sac, or from the sac itself* (*e*). This opinion is confirmed by the observations of **Wardrop** (*f*), **Lambert** (*g*), **Evans** (*h*), **Bushe** (*i*) **Mott** (*k*), and **Montgomery** (*l*), who, in aneurysm of the carotid artery, have tied the vessel above the swelling, and effected a cure.

Dupuytren supposes that the small branches between the sac and the seat of ligature may become useful, as they proportionally afford a passage for the blood, and prevent the too great extension and tearing of the sac. **Wardrop** also considers the objection of some branches between the sac and the ligature as no necessary reason against the operation.

[The operation of tying the artery beyond the aneurysmal sac, was according to **Boyer** proposed nearly sixty years since by **Brasdor** in his lectures, but never performed by him; it was also recommended by **Desault**, as feasible where it was not possible to tie the vessel between the heart and the sac, but neither did he perform it. The operation, however, was at last undertaken by **Deschamps**, in a man of sixty years old, who had a femoral aneurysm, seventeen inches in circumference, so high up that there was not a finger's breadth between the sac and **Poupart**'s ligament. The vessel was tied below the sac in hope that the blood, arrested in its progress through the vessel, would coagulate. The tumour, however, continued to pulsate and increased so much after the operation that on the fourth day, its bursting being dreaded, **Deschamps**, compression of the iliac artery being made as it left the belly, "plunged the bistoury into the upper part of the tumour and opened it down to the bottom." * * * A large quantity of fluid blood immediately escaped and he removed a mass of clot and fibrinous concretions larger than the fist. The sac having collapsed, a long space was left between the upper angle of the cut and the compressing pad. He therefore continued the cut upwards as far as the hand of the assistant who was making pressure, so that he might discover the precise situation of the gap in the artery, which he could only see occasionally, being constantly flooded with the blood, notwithstanding the care taken to compress the artery. A long probe was passed into the upper portion of the vessel, which was raised up as high as possible, and the ligature quickly applied, on account of the enormous loss of blood. * * * As blood was seen to flow from below upwards he applied a ligature of wax thread tied with a double knot below the sac. * * * The patient lost such a quantity of blood that he fell into a state of syncope, from which he did not recover; * * * he gradually sunk and died eight hours after the operation." (p. 196–98.) Both operations were performed in a very bungling and inefficient manner; for, as appeared by **Deschamps**' dissection, in the first, "the ligature included the artery, the femoral vein and a small portion of the great

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(*a*) Œuvres Chirurgicales, vol. ii. part 4.

(*b*) Recueil périodique de la Soc. Médic. de Paris, vol. v. p. 188.

(*c*) **Hodgson**, above cited, p. 301.

(*d*) **Burn**'s, A., Observations on the Surgical Anatomy of the Head and Neck. Second Edition. Glasgow, 1824. 8vo.

(*e*) **Hodgson**, above cited, p. 302.

(*f*) On Aneurism and its Cure by a new Operation. London, 1828. 8vo.—Med.-Chir. Trans., vol. xiii. pt. i. — **Horn**'s Archiv. für medic. Erfahrung. 1825. Sept. Oct., p. 277.—Lancet, 1826, Dec., vol. xi. p. 365—Magazin der ausländischen Literatur von **Gerson** und **Julius**, March, April, 1827, p. 343.—The Examination of Arteries after death, ibid., March and June, 1827.-Lancet, vol. xii.

(*g*) Lancet, vol. xi. p. 801; vol. xii. p. 218.

(*h*) Ibid. vol. xiii. p. 187.

(*i*) Ibid., vol. xiv. p. 149.

(*k*) American Journal of the Medical Science, vol. v. p. 287.

(*l*) Medic.-Chir. Review, 1830, Jan. In this case the sac enlarged ten weeks after the operation, formed an abscess, on opening which eight ounces of stinking chocolate-like fluid escaped. The opening was enlarged, all the blood clot removed, the sac filled with charpie, and permanent cure effected.—**Oppenheim**, N. W., Ueber die Unterbindung der grösseren aneurysmatischen Gefäss-Stämme an den, vom Herzen entfernten, Theile der Geschwulst; in **Rust**'s Magazin, vol. xxx. p. 100.—**Marjolin** et **Berard**, Dictionnaire de Médecine, vol. iii. p. 60.—**Vilardero**, Thèse de Paris, 1831, No. 158

adductor muscle; and in the second, the upper ligature was situated three lines above the aneurysmal sac, and included the femoral artery and a third of the *profunda* which had been pierced by the needle; the ligature of reserve placed above the last, passed between the femoral artery and the *profunda* accurately surrounding the former, the lower ligature applied in the second operation was upon the artery six lines below the sac, and the vein had been wounded by he needle." (p. 199.) From this account it is pretty clear that the higher origin than usual of the *profunda* and its firm connexion with the aneurysmal sac, would have little to do with the fatal result of this horrible operation, the ill success of which, alone to be expected, could not however present any real objection to the operation proposed by Brasdor, if properly performed.

Astley Cooper tied the femoral artery below the sac of an external iliac aneurysm "between the origins of the epigastric artery and of the *profunda*. The pulsation continued, but the tumour did not increase in size after the operation. The ligatures separated favourably. The aneurism diminished so considerably, that it was conceived in a little time, if its diminution continued, it would be possible to tie the external iliac artery above the tumour. The patient went into the country to recruit his general health, where the aneurism burst underneath the *peritonæum*, and he died in consequence of extravasation of blood into the cellular membrane of the *pelvis* and *scrotum*. In this instance, the femoral artery was tied below the origin of the epigastric and circumflex iliac arteries; a current, therefore, continued to pass through the sac into these vessels; consequently the blood was not at rest in the aneurism, and did not coagulate. After the ligature of the artery, the blood was transmitted more readily through the internal iliac than through the arteries which originate below the aneurism, namely, the epigastric and circumflex iliac. The contraction of the sac, therefore, appears to have been the consequence of the diminution of the stream which passed through it, in the same manner as an aneurism contracts, although a current enters it after the ligature of the artery, at a distance from the disease." (pp. 301, 302.)

For some time this operation was entirely given up, and was, perhaps hastily, designated by Allan Burns (*a*) as being "absurd in theory, and experience proves that it is ruinous in practice." (p. 159.) Wardrop (*b*), however, revived it in 1822, considering "that the changes which such an operation produces both in the artery and sac, are precisely those which nature employs when she cures the disease by a spontaneous process." (p. 19.) In the course of his reasoning to prove the superiority of tying the artery beyond the sac, over tying it between the heart and the sac, he makes some very odd and, as seems to me, incorrect observations; for instance, "when the artery is tied on the cardiac side, the blood cannot make its escape, and cannot be pushed through the capillaries into the veins. It must remain in the sac, and must either be absorbed or be evacuated by a process of inflammation and ulceration of the sac." (p. 22.) Now, unless the disease be of long standing, and of such size, that whatever practice be pursued, burst the sac will, it is rare that the bulk of the contents of the sac are absorbed; the greater quantity of the blood is generally fluid, and the rapid subsidence of the swelling, after the artery has been tied above, proves clearly that the blood does make its way into the veins without any "pushing," whilst the remaining coagulated part quietly rests, often for years, without causing any inconvenience, as will be shown by the dissection of Astley Cooper's and Key's cases, hereafter to be mentioned. Inflammation and ulceration of the sac are of rare occurrence, so far as I have had opportunity of observing. Wardrop's explanation of the diminution of the bulk of the aneurysmal tumour, after tying the distal part of the artery, is one utterly incomprehensible. "The fluid blood," says he, "can find a *ready exit into the trunk* from whence it came, and thus again passes into the circulation, in place of, as in the other case, having to passs through the capillaries into the veins; and, as nature immediately finds a new channel, there is no more blood impelled into the tumour afterwards." (p. 22.) How "the fluid blood can find a ready exit into the trunk from whence it came," is rather puzzling I should think to the blood, which must be constantly "pushed" forward by every fresh portion propelled by the heart; and it must be a very "new channel" indeed which nature finds, if the blood have "a ready exit into the trunk from whence it came." No Surgeon who has observed the consequence of a ligature applied between the heart and the aneurysmal sac, presumes to say that "to allow the process of coagulation to go on in an aneurism, it is necessary to put a complete stop to the circulation of the blood in the tumour." (p. 60). Home (*c*), in describing Hunter's operation, speaks only of "the force of the circulation being taken

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(*a*) Surgical Anatomy of the Head and Neck.

(*b*) Case of Carotid Aneurism successfully treated by tying the artery beyond the tumor; in Med.-Chir.Trans., vol. xiii. 1825; also On Aneurism, and its Cure by a new operation. London, 1828, 8vo.; from which here quoted.

(*c*) Trans. Med. and Chir., vol. i.

off from the aneurismal sac." (p. 147.) In some of **Hunter**'s cases the pulsation did continue; and it is probable that there is always some degree of circulation through the aneurysmal swelling, after the ligature has been applied, although not sufficient to convey an impulse to the walls of the sac, which is only produced when the disease has existed so long that the anastomosing vessels have begun to enlarge and bear a share in the circulation, as they do in spontaneous cure of aneurysm. It is not also "a curious circumstance that the natural or spontaneous process does not affect a cure, on the principle of the Hunterian operation, by *completely arresting* the passage of the blood into the sac;" for, as just noticed, **Hunter**'s operation proposes nothing of the kind. Nor is the "natural or spontaneous process in strict conformity with the principle of the operation I (**Wardrop**) am now endeavouring to establish; that is, by the formation of *a barrier in the artery beyond or at* the distal side of the aneurism." Nor is it correct to state that "in a case of aneurism Mr. **Mackelcan** found that nature had nearly completed a cure of the disease on this principle;" for "the carotid artery was plugged up, and the large aneurismal swelling was filled with a coagulum, leaving only a comparatively small channel for the blood to pass into the subclavian artery;" (p. 61) which was certainly *not a barrier* in the artery beyond, or at the distal side of the aneurysm. The operation of tying the artery beyond the sac may be permissible in some instances when its ligature on the hither side cannot be performed, but the principle on which it must be conducted, and the success which may be therefrom expected, must be otherwise explained than as **Wardrop** has set it forth.—J. F. S.

With regard to the operation of applying a ligature beyond the aneurysmal sac, **Lawrence** (*a*) observes "the circumstances under which aneurisms are placed, in reference to the trunk, and with respect to such an operation are not always alike; in fact, we may distinguish two cases in which the results of this operation may be very different. In the first place, we might reasonably expect to succeed if we could place a ligature upon an artery leading from an aneurismal tumour. under circumstances that would prevent the current of blood through the aneurism. We should expect here the same result as when we cut off the supply of blood, by placing a ligature between the aneurismal tumour and the heart; but there are very few arteries that are so circumstanced, perhaps the carotid artery is the only one. If an aneurism be situated at the lower part of the carotid artery, suppose the common carotid artery be then tied, we know that no branch is given off between the ligature and the aneurism, by means of which the circulation in the tumour can be carried on; therefore, if it were tied effectually, there could be no current of blood through the tumour, that the coagulation might take place necessary for the cure of the aneurism. Mr. **Wardrop** first tried the operation in a case of this kind, and it was completely successful. The operation was subsequently performed in a case of aneurism of the carotid artery, and it appeared again to have been completely successful, so far as the contraction of the tumour was concerned; but the patient unfortunately died in consequence of hæmorrhage from the upper orifice of the artery where it had been tied, from the remote orifice of the artery, a circumstance, however, that does not at all diminish the value of the inference that is to be drawn from the operation, as far as regards the principles upon which it is founded. When, however, we come to aneurism on the trunk of the axillary, or femoral artery, the case is different; if we tie the vessel *beyond* the tumour, in either case there are important branches given off between the disease and the ligature, by which, probably, a current of blood will continually be kept up through the tumour. In a case of aneurism of the femoral artery, for instance, we should hardly be able to tie the trunk of the vessel beyond the tumour, above the origin of the *profunda;* if, therefore, the *profunda* be left going off either from the aneurismal sac, or from any part between the aneurism and where the trunk of the artery has been tied, we should expect from the active circulation which would be kept up through the tumour, that the operation would fail. In cases of aneurism of the axillary artery, there are a variety of large branches situated, near to the tumour, so that we could not apply a ligature on the distal side, between them and the tumour itself, and these branches would keep up the circulation of the blood through the tumour in the same way that it would be maintained if no ligature were applied. The two cases seem, therefore, to be very different in point of principle; that in which the aneurism is situated near the trunk, and where the vessel gives off no branches between the disease and the ligature; and that in which it is so situated, that numerous branches are given off between where we can apply a ligature, and the situation of the aneurismal tumour. Still, as I have already said, the question is one of experience, and, until it has been fairly tried, we cannot venture to assert that the application of a ligature on the trunks of both femoral and axillary arteries *beyond* the aneurismal tumour, may not be effectual." (p. 165.)]

(*a*) Lectures in Lancet, vol. ii. 1830.

Second Section.—OF ANEURYSM IN PARTICULAR.

I.—OF ANEURYSM OF THE CAROTID ARTERY AND ITS BRANCHES.

1434. Aneurysm of the carotid artery is usually situated at its bifurcation; it has, however, been noticed on various parts of its common trunk, near its origin, and on its branches, the ophthalmic, temporal, and others. The *diagnosis* rests on the general symptoms which characterize aneurysm; with which it is also to be remarked that the aneurysm does not move in swallowing, like pulsating swellings of other kinds, in the neck, which, for the most part, are connected with the thyroid gland. Besides, it is generally accompanied with violent tearing pain in the entire half of the head, beating in the head, sudden loss of recollection, and, according to the different seat and size of the aneurysm, difficulty in breathing.

Burns (*a*) has often felt an enlargement of the common carotid, and of the root of the internal carotid, after death and twice during life, forming a swelling as large as a filbert nut, which caused no pain. I have noticed such an expansion in a strong young man, upon the bifurcation of the carotid, which arose after violent exertion; excepting a violent beating it was unaccompanied with any inconvenience, and did not increase for several years. Syme, J. (*b*), observed a case of aneurysm of the internal carotid artery, which formed a pulsatory swelling in the throat; and, from its situation, resembled an abscess in the tonsil. Tying the carotid artery did not stop the pulsation, and the patient died.

1435. Tying the carotid artery is the only remedy which can be employed in aneurysm of that vessel, if the seat and size of the swelling especially permit.

Acrel (*c*) has restored the artery in an expansion (*Aneurysma verum*) of the trunk of the carotid artery, by gradual and strong compression as the place permitted, after four or five months, to its natural strength.

1436. Numerous observations have proved that, after tying the common trunk of the carotid artery, the brain is sufficiently supplied with blood, and that no disturbance of its functions ensue. Besides the numerous small anastomoses, the carotids of both sides communicate, and the vertebral arteries, by large inosculations in the region of the cellular sinuses, of the cuneiform process of the occipital bone, the *falx*, and the halves of the *cerebellum*, but especially by one peculiar branch from the deep artery. The vertebral arteries at the same time assume the function of collateral branches.

Tying the carotid artery (previously undertaken by Abernethy (1) and Lynn in wounds) was first and afterwards frequently performed for aneurysm by Astley Cooper (*d*). Maccill (*e*), in the space of one month, tied both carotid arteries for tumours of both eyes. Several months after the operation, the patient was well and the swellings had subsided. Mussey (*f*) tied both carotids at an interval of six weeks, on account of inosculating arterial swellings, and the case recovered.

[(1) Abernethy was not the first person who tied the carotid artery; for Hebenstreit, in the fifth volume of his translation of Benjamin Bell's *System of Surgery*, mentions a case which he had met with, where the external carotid artery was wounded in the extirpation of a schirrous tumour. The profuse hæmorrhage which instantly

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(*a*) Observations on the Surgical Anatomy of the Head and Neck. p. 163.

(*b*) London and Edinburgh Monthly Journal of Med. Science, Nov. 1842.

(*c*) Chirurgische Vorfälle, vol. i. p. 253.

(*d*) Account of the First Successful Operation performed on the common Carotid Artery for Aneurysm, in the year 1808, with the *post mortem* examination; in Guy's Hospital Reports, vol. i. p. 53. Jan. 1836.

(*e*) New York Medical and Physical Journal, vol. iv. p. 576.

(*f*) American Journal of Medic. Sciences, vol. v. p. 316.

ensued would soon have destroyed the patient, if the Surgeon had not immediately recollected himself and tied the trunk of the artery. "The operation was successful, and the patient lived many years after it" (*a*).

Abernethy's operation (*b*) was performed about 1798 or 9, on a man whose neck was gored by a cow. The horn "had passed beneath and torn the internal carotid artery, and all the branches in front of the external carotid artery. The former vessel was not, however, entirely rent asunder, so that the general course of the artery, and its connexion with the *cranium* remained in the usual state." (p. 117.) The vessels did not at first bleed, but soon did, but this was checked by pressure on the common carotid artery, which could not, however, be borne, and the patient's struggles removing the pressure, repeated bleedings ensued. The wound was therefore enlarged, the artery found and tied, but he died thirty hours after the ligature had been applied. (p. 125.)

Fleming (*c*) successfully tied the carotid in 1803, for secondary bleeding, in a sailor who had attempted to commit suicide. The wound had healed so rapidly that on the seventh day the ligature was completely buried in granulation, and required removal by a cautious dissection." (p. 4.)

The common carotid artery was first tied by Astley Cooper (*d*), in November, 1805, for aneurysm of the right carotid; the ligatures were drawn from the wound on the eleventh day, but the woman died on the nineteenth day, having suffered much from difficulty in swallowing. He tied it in another case in June, 1808; the upper ligature came away on the twenty-second, and the lower on the twenty-third day, and this patient recovered. The account of the state of the vessels thirteen years afterwards will be found below.

Travers (*e*) tied the carotid artery in the following year successfully for a case of aneurysm by anastomosis in the orbit, in a woman of thirty-four years of age.

The carotid artery has since been tied frequently with success; and there is one very interesting instance in which Dr. Robertson, of Edinburgh (*f*), operated in a case where an aneurysm had burst into the *œsophagus*, and the space was so little, that the artery was taken up only half an inch above the bifurcation of the *arteria innominata*; the ligature came away on the seventeenth day, and the patient recovered.

Zeis, of Dresden (*g*), tied the carotid artery in an infant of fifteen months for a vascular *nævus* on the left side of the face. After having exposed the edges of the *m. sterno-mastoideus*, a vein, about the thickness of a quill, was found lying across the bottom of the wound; this he tied and divided. There was not any arterial hæmorrhage, but dark venous blood oozed out, which was stopped by the application of kreosote water. On opening the sheath, and exposing the internal jugular vein, another large gush of blood ensued, and was stopped by kreosote water. The vein which had been tied swelled so much as to excite fear of its bursting, and was therefore tied again higher up; after which the artery was tied with a silk thread. The tumour immediately became smaller and paler, shrivelled up, and exhibited in various spots, a greenish yellow colour, like an *ecchymosis* of four or five days standing. On the fourth day the ligature on the vein came away, and on the following night a considerable venous bleeding took place, which recurred six times in the course of the next twenty-four hours, but each time was arrested by the kreosote water. On the evening of the eighth day the ligature came away; the bleeding ceased, and after seventy-two days the wound had healed. Several weeks after the operation, the tumour had increased with the nutrition of the body, and became very large, when the child cried. About a week before the complete healing of the wound, the child was attacked suddenly with convulsions and *hemiplegia* of the right side; these symptoms continued with increasing debility, and on the forty-ninth day after the attack of convulsions, the child died. The vascular *nævus* had for some days disappeared, leaving only a few folds of the skin. No examination was allowed.

Kuhl (*h*), of Leipzig, has tied both carotids with success at an interval of twenty-seven days, for a pulsating aneurysmal tumour of the scalp, consequent on wound on the *occiput*, from which there were repeated bleedings. The application of the ligature was followed by convulsions, other troublesome symptoms, heaviness and throbbing of the head, for which it was necessary to employ venesection, though the case at last did well.]

1437. *Tying the common trunk of the carotid artery* may be performed at three different places, according to the different seat of the aneurysm, viz.:

(*a*) Scarpa, Wishart's Translation, note, p. 409.

(*b*) Surgical Works, vol. ii.

(*c*) Medico-Chirurgical Journal, vol. iii. p. 1.

(*d*) Medico-Chirurgical Transact., vol. i. p. 1.

(*e*) Med.-Chir. Trans., vol. i. p. 222.

(*f*) Dublin Journal of Medical Science, &c., vol. xii. p. 335. 1838.

(*g*) Zeitschrift für die gesammte Medicen, vol. iii. part 1.

(*h*) Radius und Clarus, Beit. zur prakt. Heilkunde. Leipz., vol. ii. p. 245.

first, immediately above the collar-bone; *second*, below the part where the *m. omo-hyoideus* crosses the carotid; *third*, above that point. If the seat and extent of the swelling do not permit the ligature below the aneurysm, it must be applied above (*par.* 1433.) The patient is to be placed horizontally upon a couch, the head supported by a pillow, and the diseased side of the neck turned properly towards the light.

1438. In tying the carotid artery *immediately above the collar-bone*, a cut of two inches and more should be made through the skin and *m. platysma myoides*, from the top of the breast-bone along the inner edge of the *m. sterno-cleido-mastoideus.* When the edge of this muscle is laid bare, it must be separated from its cellular connexion with the *m. sterno-hyoideus* and *sterno-thyroideus*, and drawn outwards, whilst the latter two muscles are drawn inwards, with a blunt hook, by an assistant. The *m. sterno-cleido-mastoideus* is now to be relaxed by inclining the head to the affected side. The internal jugular vein appears in the wound, and must be drawn outwards, with the forefinger of the left hand from the artery, the sheath of which is then to be opened with delicate and careful strokes of the scalpel; or, when the vein has been fixed externally by an assistant, the sheath is to be raised with forceps, and carefully cut into; the artery should be carefully isolated with the handle of the knife, and the ligature applied round it with DESCHAMPS' needle.

The operation is always most difficult at this part, on account of the depth of the artery beneath the *m. sterno-cleido-mastoideus*, and because it is entirely covered by the jugular vein.

ZANG (*a*) has proposed that an incision, beginning from the top of the cricoid cartilage, should be carried outwards *between the two portions of the m. sterno-cleido-mastoideus*, and terminate at a quarter of an inch from the collar-bone; the skin and *m. platysma myoides*, and the edges of the wound must be kept asunder with the blunt hook, the cellular tissue and *fascia* of the neck divided, and thus the triangular space formed by the sternal and clavicular insertion of the sterno-mastoid muscle reached. The internal cervical *fascia* is then to be cut through, the thyroid gland drawn inwards, the jugular vein and pneumo-gastric nerve outwards, the artery taken hold of by the forceps, gently raised, and a ligature passed with a proper needle close to the part where the artery is covered by the *m. omo-hyoideus.*

According to DIETRICH's proposal (*b*), an incision is to be made on the mesial line of the windpipe, from the semilunar notch at the top of the breast-bone, to the cricoid cartilage, from two and a half to three inches in length, through the skin, cellular tissue, *m. platysma myoides*, and external cervical *fascia*, by which the small veins running from above downwards are avoided. The tendinous connexion between the *m. sterno-hyoideus* and *sterno-thyroideus* is then to be divided, the edges of the wound drawn asunder with a blunt hook, and the muscles just mentioned pushed from the windpipe, with the handle of the knife, and carried towards the shoulder. The branches of the inferior thyroideal vein, as well as the thyroid gland, which appears from the middle to the upper end of the wound, must be avoided. The finger is to be introduced into the wound downwards and outwards, after the cellular tissue has been divided with the handle of the knife, and the vessel is felt enclosed in its sheath, which is then to be opened, the artery a little raised, and the ligature introduced.

As upon the left side the carotid artery lies deeper and nearer to the *pleura*, the jugular vein and pneumo-gastric nerve higher, and the thoracic duct close behind the sheath of the artery, the performance of the above mode of treatment the more difficult.

The following method, proposed by COATES (*c*), is more easy and more sure. A cut from two to two and a half inches long, is to be carried upwards from the upper edge of the breast-bone, upon the inner edge of the sterno-mastoid muscle; from the lower end of this incision, a second is to be made parallel to the upper edge of the collar-bone, to the inner edge of the clavicular part of the sterno-mastoid muscle, about

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(*a*) Blutige Operationen, vol. i. p. 233.

(*b*) Above cited, p. 162.

(*c*) Medico-Chir. Trans., vol. xi. pt. ii.

an inch and a half long: the cellular tissue, *m. platysma myoides*, and external cervical *fascia*, is to be divided in the two cuts. A director is then to be carefully thrust under the sternal portion of the sterno-mastoid muscle, which should be cut through three lines from the upper edge of the collar-bone, together with the internal cervical *fascia*. The flap is turned somewhat upwards, and held back with a blunt hook. The cellular tissue is then to be divided, and, if there be much fat, it must be removed partly with the scissors, forceps, or bistoury, so that the vessels, with their sheath, behind the collar-bone, and on the outer edge of the *m. sterno-hyoideus*, may be brought into view. These muscles are to be inclined with the handle of the knife towards the wind-pipe, and the sheath, opened with the greatest care, and without any violence, as the delicate walls of the thoracic duct, which lies close behind the sheath, are torn with the slightest violence. The isolation and tying of the artery is effected in the way already described.

1439. If the aneurysm be higher up, the tying of the carotid artery must be effected *below the part at which the m. omo-hyoideus crosses.* A cut is to be made through the skin and *m. platysma-myoides*, in an oblique direction along the inner edge of the *m. sterno-mastoideus*, commencing at the top of the cricoid cartilage, and terminating an inch from the sternal end of the collar-bone. When the edge of the sterno-mastoid muscle is exposed, it must be separated carefully from the sterno-hyoid muscle, and drawn outwards; the omo-hyoid muscle then appears crossing over the vessels of the neck, and the carotid artery, jugular vein, and pneumo-gastric nerve enclosed in their sheath, with the descending branch of the hypoglossal nerve upon it. The omo-hyoid muscle is now to be drawn outwards and upwards, the thyroid gland inwards, and the jugular vein with the fore-finger of the left hand outwards, and there kept (1). The sheath is now to be opened, immediately where it covers the carotid artery, either with a director, or, if carefully raised with the forceps, with the scalpel held flat, or, what is best, with some careful strokes of the scalpel. The artery should now be separated from the surrounding parts with the handle of the knife, to an extent sufficient for passing around it the ligature with DESCHAMPS' needle.

As the swelling up of the jugular vein often renders the isolation of the artery very difficult, this may be facilitated by applying compression on the vein above, with the finger. For the purpose of not injuring the important surrounding parts in isolating and tying the artery, it is to be borne in mind that the jugular vein lies on its outer side, and upon it; the pneumo-gastric nerve between the vein and artery, and the sympathetic nerve behind them. As important varieties in the course of the vessels of the neck, in connexion with this operation, it must be remembered that the division of the carotid artery often takes place deep in the bottom of the neck, and that the vertebral artery arises from the *aorta*, or the subclavian ascends along the side of the carotid, and close behind it. If the artery be laid bare, as proposed, to a great extent, two ligatures must be applied, and the artery tied at the upper and lower part of the exposed portion (*a*).

[(1) ASTLEY COOPER (*b*) observed in his first operation for carotid aneurysm, that "the motion of the internal jugular vein produced the only difficulty in the operation, as, under the different states of breathing, it sometimes presented itself to the knife tense and distended, and then as suddenly collapsed." (p. 3.) This, however, is not always the case, as in an instance mentioned by HODGSON where the carotid artery was tied for a spurious aneurysm, the result of wounding the vessel with a penknife, "the jugular vein afforded no trouble in the operation; it was not even seen." (p. 332.) And in another operation, by Dr. JOHN BROWN, of Meath (*c*), for wounded carotid by a penknife, the vein "did not appear, nor was it a source of the slightest inconvenience in the operation." (p. 305.)

If, however, the vein be wounded in the operation, it must be tied as was done by SIMMONS, of Manchester (*d*).]

1440. If the carotid be tied *above the crossing of the m. omo-hyoideus*, (which is only possible when the aneurysm is seated in the branches of

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(*a*) HODGSON, above cited, p. 342.

(*b*) Med.-Chir. Trans., vol. i.

(*c*) Dublin Hospital Reports, vol. i.

(*d*) Cyclopæd. of Pract. Surgery, vol. i. p. 262.

that vessel, or when the aneurysm is deep, and the artery must be tied above it,) the cut must be carried either from the top of the cricoid cartilage two inches upwards, in the direction of the inner edge of the sterno-mastoid muscle, or commenced at the upper edge of the thyroid cartilage, and, on the contrary, carried down a sufficient length along the inner edge of the sterno-mastoid muscle. In this case the operation is to be proceeded with as before, only the omo-hyoid muscle must be drawn downwards. In other cases, when the skin, *m. platysma myoides* and cellular tissue are divided, the edges of the wound must be held asunder, a thin layer of cellular tissue divided; and, in the triangular space formed at the lower end of the wound, by the crossing omo-hyoid muscle, at the upper end of the wound, by the digastric muscle, and externally, by the inner edge of the sterno-mastoid muscle, the artery must be isolated, as already mentioned (*a*).

The superior thyroideal vein above the cricoid cartilage, crosses the common carotid artery, and with it the laryngeal and pharyngeal vein, as well as some branches anastomosing with the external jugular vein, run together before the carotid, and partially form some anastomoses. These veins must be avoided, and drawn upwards (1), and the superior thyroideal artery inwards.

[(1) I have on one or two occasions seen these veins wounded in tying the carotid artery; they bled very freely, but were soon stopped by a little pressure.—J. F. S.]

1441. When in one or other way the ligature has been carried round the carotid artery, it must be fastened sufficiently tight with two single knots; the one end of the ligature cut off near the knot, the other brought out of the wound by the shortest course, and the union of the edges of the wound effected with sticking plaster. Such symptoms may occur after the operation as have been already generally mentioned. The patient should be kept quiet in bed, with his head somewhat raised, and bent forwards. On the fourth or fifth day the dressing is to be renewed. The patient should be treated antiphlogistically, according to the symptoms, and with suitable antispasmodics, if cramps come on. After tying the carotid, it is not uncommon that, on account of the great anastomosis, the pulsation in the sac reappears; no further increase, however, is to be feared; it gradually becomes weaker, and the sac diminishes.

For the history of the ligature of the common trunk of the carotid artery, and the collection of the hitherto known cases, see Dietrich (*b*).

[The following is the account of the dissection of the second case in which Astley Cooper tied the left common carotid artery in 1808, for aneurysm (*c*), the patient having died thirteen years after of apoplexy (*d*). "The disease of which he died sufficiently attested the freedom of the circulation, as well as its force in the cerebral vessels, on the side on which the carotid had been tied. The arteries on the left side of the brain were rather larger than those on the opposite side. The anterior cerebral artery was of the same size as its fellow: the middle cerebral larger than that on the right side, which was filled with coagulum and did not admit the injection. The large size of the latter vessel is accounted for by the increased size of the communicating branch; which receiving its blood from the basilary, had become as large as an ordinary radial artery. The basilary appeared to be of its usual capacity, although it was evidently the channel which supplied the middle cerebral artery. The blood probably found an easier course from the basilary, through the left communicating branch, than into the right corresponding vessels, which appeared rather diminished in size. From an inspection of the base of the brain after the vessels had been injected it immediately struck the observer, that the left side of the arterial circle of Willis was much more developed than the right, and that the left side of the brain received its full share of arterial blood. The anterior cerebral artery received its supply from its fellow by means of the transverse branch: these vessels seemed to be of their usual size. The

(*a*) Dietrich, above cited, p. 180.

(*b*) Above cited, p. 132.

(*c*) Med.-Chir. Trans., vol. i. p. 222. 1809.

(*d*) Guy's Hospital Reports, vol. i. 1836.

internal carotid was pervious for about half an inch, and of its ordinary capacity. The external vessels were not so well displayed. Those of the face did not receive the injection. The common carotid trunk was impervious throughout its whole extent, being reduced to a mere cord. The external carotid was injected at its commencement: and the superior thyroideal was filled from the arteries of the opposite side; but beyond this the arteries were empty and therefore could not be satisfactorily traced. The free communication of the branches of the external carotids, in their natural state, affords an ample channel of supply, when the circulation in one is cut off. The aneurism must, as Sir Astley Cooper suspected, have been situated in the internal carotid artery. (p. 57.) The preparation of the carotid arteries of this case is in the Museum at St. Thomas's.]

1442. If an aneurysm be seated in the branches of the carotid, the tying of the affected artery must, if possible, be performed. This tying may also be required on account of other diseased conditions. We must therefore consider tying the external carotid, the lingual, the external maxillary, the temporal, the occipital, and the posterior aural. Tying the superior thyroideal artery will be mentioned in the treatment of *bronchocele*.

1443. *Tying the external carotid artery* is considered as one of the most difficult operations, on account of the vessel being surrounded with arteries, veins, and nerves, and therefore also it is usually recommended to tie the common trunk instead of it (*a*). It has, however, been performed successfully by Bushe (*b*), on account of aneurysm by anastomosis; by Mott (*c*) in removal of the lower, and by Lizars (*d*) in that of the upper jaw-bone.

Dietrich (*e*) has proposed the most convenient mode of operating; a finger's breadth from the lower edge of the lower jaw, at a distance of half an inch from the inner edge of the sterno-mastoid muscle towards the *larynx*, a cut should be made obliquely upwards, and parallel to the edge of the sterno-mastoid muscle, through the skin, cellular tissue, and *m. platysma myoides*. After the division of a thin layer of cellular tissue, the external cervical *fascia* appears, upon which run some veins, which are to be raised, and the *fascia* and the cellular tissue divided with the handle of the knife. The internal cervical *fascia* is then to be cut through with slight strokes of the knife, and, whilst the edges of the wound are held asunder with blunt hooks, the inner edge of the sterno-mastoid muscle appears on the outer edge of the wound; at its inner edge the tongue-bone is felt; at the upper angle of the wound are seen the submaxillary and parotid gland; at the under edge, the digastric muscle; and at the lower angle the omo-hyoid. With the greatest care the fat and cellular tissue filling the bottom of the wound must now be divided, keeping towards the upper angle of the wound, for the purpose of best avoiding the venous branches, to wit, the superior thyroideal, sublingual and facial, and thus the artery is exposed, partially covered by the common trunk of the facial veins. Now begins the most difficult part of the operation, to wit, the isolation of the artery from the surrounding important parts. At the upper angle of the wound the artery crosses the lower edge of the digastric muscle, as well as the principal trunk of the hypoglossal nerve, which runs parallel to the edge of the muscle; on the inside some twigs pass down from the hypoglossal nerve, and, at the same time, the superior thyroideal

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(*a*) Manec, above cited, pl. iv.

(*b*) Lancet, 1827–28, vol. ii. p. 482.

(*c*) American Journal of Medical Sciences, vol. ix. 1845.

(*d*) Lancet, 1829–30, vol. ii. p. 54.

(*e*) Above cited, p. 186.

artery and vein run down from above to the internal jugular vein. The trunk of the facial veins lies in part upon the artery, and upon the wall of the artery descends a branch of the hypoglossal nerve. On the outside of the artery are the internal carotid artery, and the internal jugular vein, which frequently covers the latter artery; together with them descend the pneumo-gastric and sympathetic nerves, which divide into many branches. Between, and rather behind the two arteries, passes up with, and very near it, the ascending pharyngeal artery, from the external carotid. The laryngeal nerve, as well as branches of the hypoglossal nerve, cross it deeply, passing on the back and inner part inwards and upwards. The external carotid artery is best tied either above the giving off of the superior thyroideal, or where it crosses the lower edge of the digastric muscle. This muscle, and the hypoglossal nerve, must therefore be somewhat separated from the cellular sheath, and with the submaxillary gland drawn upwards with a hook by one assistant, whilst another draws the internal carotid artery, the internal jugular vein, and the nerves outwards. When the operator has now in part pressed the trunk of the facial veins lying on the artery, aside and inwards, he opens the sheath of the artery with the handle of the scalpel, and passes the ligature with DESCHAMPS' needle from without inwards.

1444. BECLARD (*a*) has proposed *tying the lingual artery* in bleeding after deep extirpation of the tongue, and the like. Tying it on one side is sufficient, as the bleeding from the other side of the tongue may be stanched by cauterization. The patient lies with his head somewhat bent back, and with his face turned towards the sound side; the operator thoroughly satisfies himself of the position of the tongue-bone, which, during the whole operation, must guide him, and makes a cut from an inch to an inch and a quarter long, which he commences a little behind the horn of the tongue-bone, and carries upwards and forwards, half an inch over the body of that bone. The skin and *m. platysma myoides* are thus divided, avoiding the facial vein, which is to be turned backwards. The cellular sheath of the submaxillary gland is then to be opened, and the gland raised without injuring it, upon which the digastric and stylo-hyoid muscles, as well as the hypoglossal nerve, appear. If these different parts be very near the tongue-bone, as happens with persons who have short necks, they must be gently raised, so as to expose the outer side of the hypoglossal muscle, some fibres of which are to be seized with the forceps, raised, the director introduced under them and then divided, upon which the artery is exposed, and easily isolated.

DIETRICH (*b*) makes the cut as in tying the external carotid artery, only with this difference, that he begins three lines from the under edge of the lower jaw, and carries it two inches downwards, through the skin, cellular tissue, *m. platysma myoides*, and external cervical *fascia*. The vein being avoided, and the second *fascia* divided, the edges of the wound are to be kept asunder with hooks, when the submaxillary gland and lower edge of the digastric muscle appear at the upper angle of the wound. The cellular tissue, connecting the gland with the muscle, is to be divided, and the gland raised up, which exposes the stylo-hyoideal muscle. Both muscles and the hypoglossal nerve are to be drawn downwards or upwards, and the two layers of cellular tissue being divided with the handle of the knife, the artery now appears close to the trunk of the external carotid artery, from which it is given off. In front of the artery passes the lingual vein; often, also, on its inner and outer side the facial vein; and still further, the superior laryngeal nerve. The nerve must be drawn down, the vein up, and the

(*a*) MANEC, above cited, pl. iii.—BELL, CHARLES, Operative Surgery, vol. ii. p. 307.—WISE; in AVERILL, above cited, p. 53.

(*b*) Above cited, p. [illegible]

artery tied from below upwards, immediately above the great horn of the tongue-bone. If the artery is to be tied still more distant from its origin, it is not necessary to cut into the fleshy fibres of the hypoglossal muscle. The artery otherwise runs through sufficient extent before it passes under any muscle.

1445. The *external maxillary or facial artery is tied* at the angle of the lower jaw in the following manner. A cut is to be made on the inner edge of the masseter muscle, running obliquely downwards and outwards, to the extent of an inch or a little more through the skin, cellular tissue, and fibres of the *m. platysma myoides.* In this direction the cellular tissue and some threads of the facial nerve are cut through; and the edges of the wound being separated, the artery appears on the inner edge of the masseter muscle, lying on the *periostæum*; and close to it, on the outer side, is the facial vein; these are drawn outwards, and the artery isolated with ease.

This artery can be tied in its submaxillary part only with the greatest difficulty. MANEC (*a*) declares himself against this operation, because the artery lies very deeply, and is covered by very many parts. VELPEAU and DIETRICH have given the modes of proceeding in this operation. By the former, an incision is made from the submaxillary gland to the inner edge of the sterno-mastoid muscle, and then a second from the hinder end of the great horn of the tongue-bone to the inner edge of the masseter muscle, through the skin and *m. platysma myoides*, and the flap so formed should be turned back upwards. The edges of the wound are to be kept asunder, the flap held up, and the now displayed *aponeurosis*, from which the artery is only separated by cellular tissue, must be cut through, in doing which the facial vein is sometimes divided, between the submaxillary gland and digastric muscle; after this the artery is to be isolated and tied between the great horn of the tongue-bone and the submaxillary gland. According to DIETRICH, the cut should be made two lines from the under edge of the jaw, directly down, rather obliquely outwards and downwards, to the inner edge of the sterno-mastoid muscle. The facial vein is never to be cut through, but separated from the submaxillary gland, and carried outwards or inwards, as may be most convenient. The hypoglossal nerve is to be taken care of. The artery passes under the stylo-hyoid muscle, at the point where it is perforated by the digastric muscle, about half an inch from its insertion in the tongue-bone. The muscles together with the nerves, are to be separated from the cellular tissue, and carried downwards, and the ligature passed around the vessel from without inwards, and from below upwards.

1446. *Aneurysms of the temporal artery*, occurring after wounds, may be often cured by compression, as I have seen in one instance, when aneurysm occurred after arteriotomy; if this be not possible, the temporal artery must be tied. The position of the artery is to be first well ascertained by feeling with the finger, and then along its course a cut an inch in length is to be made through the skin, midway between the joint of the jaw and the auditory passage; a director is then to be introduced beneath the pretty thick cellular tissue by which the artery is covered, and this being divided, the artery is to be isolated. The accompanying vein lies to the outer side.

1447. *Aneurysms of the occipital artery* rarely occur, though MEYER (*b*) mentions a case in which, on account of aneurysm, many branches and the trunk of the occipital artery were tied. J. BURNS (*c*) also tied this vessel for an aneurysmal swelling. A cut is to be made half an inch behind, and a little beneath, the tip of the mastoid process, and continued obliquely upwards and backwards, to the extent of an inch or an inch and a quarter. The skin and *aponeurosis* of the sterno-mastoid muscle are to be divided, and the finger carried under the upper lip of the wound, in order to feel the base of the mastoid process. The *m. splenius* is then to

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(*a*) Above cited, pl. iv.

(*b*) Dissert. de aneurysmate arteriæ occipitalis 1804.—SCARPA, Translation, p. 199, note.

(*c*) In his brother's Surgical Anatomy of the Head and Neck, p. 374.—MANEC, above cited, pl. v.—DIETRICH, above cited, p. 209.

be divided the whole length of the wound, and the pulsation of the artery being felt, should be carefully isolated, so as not to injure the accompanying veins.

1448. *To tie the posterior aural artery*, a cut half an inch long should be made, from the lobe of the ear to the inner edge of the sterno-mastoid muscle, and continued upwards along its inner edge an inch upwards; this cut divides the skin, fatty cellular tissue, and the muscular *aponeurosis*. An assistant with a blunt hook separates the edges of the wound, and then is seen, at the lower angle of the wound, a portion of the parotid gland; but in the upper angle, the lower edge of the lower retractor of the auricle; in the middle of the wound the artery is to be sought for, isolated, and tied (*a*).

SYME (*b*) tied a branch of the posterior aural on account of aneurysm.

[ASTLEY COOPER (*c*) had a case of "aneurism of the posterior aural artery from a blow; he opened the sac, and was compelled to tie, not only the vessel which led into the sac, but numerous others entering in all parts of the circumference of the swelling." (p. 82.)

BEGIN (*d*) gives the account of an aneurysm of the middle meningeal artery, in which the bone having been absorbed, the tumour became superficial, and, being mistaken for an encysted tumour, was extirpated. An ineffectual attempt was made to stop the bleeding by plugging; but the patient could not be saved.

The branches of the internal carotid artery within the skull sometimes become aneurysmal. A remarkable instance of this kind occurred to Dr. (afterwards Sir GILBERT BLANE) (*e*), in a female of sixty-four years old, who "was suddenly seized with a fit of giddiness and dimness of sight, succeeded by acute pain in the forehead, which remained for some time. The indistinctness of vision continued for six months; after this, she was at intervals seized with giddiness, headache, and imperfect vision. She had a similar attack two years after the first, from which also she recovered to a certain degree. From this period she continued subject, from time to time, to the above-mentioned symptoms as long as she lived. She for some time saw objects double, but the particular period of this could not be ascertained." (pp. 193, 94.) She afterwards betrayed signs of mental derangement, and became maniacal, and died in that state five years after her first attack. On *examination* there was found more water than usual in the ventricles of the brain; upon the *falx*, some *spicula* of bone; and the optic nerves were smaller than usual, as if they had been wasted." The morbid appearance in this case, which was so singular, and to which the symptoms of complaint seemed chiefly referable, was to bulbs about five-eighths of an inch in diameter, filling up the hollow on each side of the *sella tursica*, which were evidently dilatations of the carotid arteries, and, from their being filled with *laminæ* of coagulated blood, there could be no doubt of their being aneurisms of these arteries. The one on the left side was the largest; that on the right communicated with the cavity of the artery, which was not the case with the other." BLANE observes:—"It is probable that one of the aneurisms arose five years before her death, occasioning the first attack described, and that the other arose two years afterwards, occasioning the other attack. It is also probable that it was between these two attacks that she saw objects double, from the unequal compression on the optic nerves." (pp. 196, 97.) HODGSON mentions an instance of a small aneurysm in the anterior cerebral artery, filled with a solid coagulum, and another in the basilar artery was seen by SERRES.]

II.—OF ANEURYSMS OF THE SUBCLAVIAN AND AXILLARY ARTERIES.

1449. Aneurysm of the axillary artery in general increases quickly, as the surrounding parts offer little opposition. The swelling raises the great pectoral muscle, spreads towards the collar-bone, and thrusts it upwards. It is, therefore, rarely that this aneurysm is so early observed, that there

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(*a*) DIETRICH, above cited, p. 211.

(*b*) Edinburgh Med. and Surg. Journ., vol. xxxi. p. 66. 1829.

(*c*) Surgical Lectures.

(*d*) Dictionnaire de Médecine et de Chirurgie pratiques, vol. ii. p. 533—article, *Anévrysme*.

(*e*) History of some cases of Disease in the Brain; in Trans. of a Society for the Improvement of Med. and Chir. Knowledge, vol. ii. 8vo. 1800.

is still space sufficient (*a*) for tying the axillary artery, and this operation is usually possible only in aneurysms at the upper part of the brachial artery.

1450. *Tying the axillary artery* may be performed in two situations, namely, *first*, by cutting through the great pectoral muscle, under the collar-bone; and *second*, by division of the tendinous interspace between the pectoral and deltoid muscles. The patient either lies on a bed or sits on a sloping chair, with the shoulders somewhat depressed; an assistant stands behind, and is ready to compress the subclavian artery, if bleeding should occur during the operation.

1451. In the *first mode* of operating, a cut must be made through the skin, commencing an inch from the sternal end of the collar-bone, and continued along its under edge towards the coracoid process of the blade-bone, as far as the cleft which separates the pectoral and deltoid muscles. In this direction the connexions of the great pectoral muscle with the collar-bone are divided, and thus the lesser pectoral muscle is exposed, which, beginning from the coracoid process, crosses the lower angle of the cut. The point of the finger is then to be introduced between the coracoid process and the lower edge of the collar-bone, and the artery is there found surrounded, upon the outer side, and partially covered by the brachial *plexus*, and upon the inner side by the brachial vein. The artery is now to be carefully separated from the vein and nerves, and a single ligature carried round it with DESCHAMPS' needle, before withdrawing which, the artery should be compressed upon it, for the purpose of ascertaining that it alone is taken hold of. The small arteries wounded during the operation are to be tied at once, and the wound kept clear of blood. The dressing and after-treatment are to be conducted according to the former general rules.

The direction of the wound in this mode of operation is variously advised. The most important variations are—that recommended by LISFRANC, in which the cut is commenced half an inch from the sternal end of the collar-bone, in the pit formed by the clavicular and sternal parts of the great pectoral muscle, and carried three inches below the collar-bone; and the practice recommended by ZANG and others, who carry the cut close beneath the collar-bone, beginning from its middle, and continue it for two and a half inches downwards and outwards, nearly to the coracoid process.

1452. In the *second mode* of treatment, if the artery be not tied so near the collar-bone, a cut is made of two and a half inches length, from the lower edge of the outer third of the collar-bone, towards the inside of the upper arm, on the interspace between the great pectoral and deltoid muscles. The lesser pectoral muscle is cut off at its insertion to the shoulder-blade. The forefinger is now to be carried deeply into the wound, and passed upon the surface of the *m. serratus magnus*, till its tip reach the shoulder-blade. The finger is now curved, and, following the inner surface of the subscapular muscle, is again carried forwards, up to the outer lip of the wound in the skin. In this way is the whole armpit swept round, and the entire mass of vessels and nerves, collected immediately under the collar-bone, are without difficulty brought to the external parts between the edges of the wound, and fixed with the finger. Here the artery is easily isolated and tied (*b*).

[The operation of tying the axillary artery in either mode above recommended, or indeed in any other way, has not met with much favour among practical Surgeons; the position of the vein so much in front of it, and its almost complete envelopment by the

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(*a*) KEATE; in London Medical Review, 1801.— PELLETAN, Clinique Chirurgicale, vol. ii. p. 49.— CHAMBERLAINE, Medico-Chir. Trans., vol. vi. p. 128.

(*b*) DELPECH, Chirurgie Clinique de Montpellier, vol. i.

axillary nerves, together with its great depth, render it a very hazardous and difficult operation. As to dragging up the whole mass of vessels and nerves to the surface, and then selecting the artery to be tied, as recommended by Delpech, no person who had had any experience in tying arteries, would think of doing, on account of the necessary detachment of the vessel from its connexions, which would put it into a very unfavourable condition for the effusion of adhesive matter on its exterior, and interfere with its healing up. And indeed, though this might be done on a vessel undiseased, yet if any aneurysmal swelling existed, there would not be room to attempt it. Nor is there any good reason to perform so troublesome and dangerous an operation, when tying the subclavian above the collar-bone will answer all the purposes required, with greater ease and safety. If the artery were wounded and its ends exposed, as in Hall's case, related by J. Bell (*a*), and Maunoir's case, mentioned by Scarpa (*b*), then ying the ends of the wounded vessel would, as under ordinary circumstances, be required. But for aneurysm of this vessel, tying the subclavian is always preferable.—J. F. S.]

1453. If an aneurysm situated upon the commencement of the axillary artery, or at a deep part of its commencement, so extend, that it reach the collar-bone, the *subclavian artery must be tied above the collar-bone.* The patient being seated on a chair, or laid horizontally upon a table, and the shoulder of the ailing side depressed as much as possible, a cut is made through the skin, extending from the outer edge of the sterno-mastoid muscle, along the collar-bone, to the clavicular insertion of the *m. trapezius.* Then the *m. platysma myoides* is to be divided carefully in the same direction, so that the external jugular vein may not be wounded, which, when laid bare, is to be drawn towards the shoulder with a blunt hook. The cellular tissue in the midst of the wound is next divided with the knife, or more safely with the finger, or a director, till the edge of the *m. scalenus anticus* be reached with the finger, where the artery is found lying on the first rib, and the ligature is to be carried round it with Deschamps' or Desault's needle.

The cut for tying the subclavian artery, should, according to Zang, be made in the middle of the triangle, formed by the hind belly of the *m. omo-hyoideus*, and the hind edge of the clavicular part of the *m. sterno-cleido-mastoideus*, and should be commenced two inches above the collar-bone, at the hind edge of the latter muscle, and carried somewhat obliquely outwards and downwards to the middle of the collar-bone.

I have found this operation easiest on the dead subject; the subclavian vein lies on the inside of the artery, the nervous *plexus* on the outside, and partially covering it. A little stud on the first rib, which is felt at the inner side of the artery, and the hollow made by the artery in that rib, are given as the certain marks for directing the finger upon the artery. Taking up this artery is often extraordinarily difficult, and even impossible (*c*), if, from the size of the swelling, the collar-bone be very much thrust up; the operation should therefore always be performed early. The same also happens in tying the ligature for which Liston (*d*) has proposed a peculiar contrivance. As the artery is partially covered with the *plexus* of nerves, one of the nerves may be taken up and tied instead of the artery, as pulsation is propagated to it (*e*).

In one case where the ordinary mode of treatment was inapplicable, Dupuytren (*f*) cut through the *m. scalenus anticus.* Hodgson, Lisfranc, and Graefe, have proposed the same in their modes of practice, that, after a long cut has been made through the skin and the *m. platysma myoides*, from the hind edge of the sterno-mastoid muscle, from two to two and a half inches along the collar-bone, the operator should dip deeply, and seek for the *m. scalenus anticus*, pass beneath it a curved director, raise it up, and cut it through either from without inwards, or carefully across, without previously introducing a director.

(*a*) A Discourse on the Nature and Cure of Wounds. Third Edit., Edinburgh, 1812, p. 59.

(*b*) Wishart's Translation, above cited, p 412.

(*c*) Cooper, A., London Medical Review, vol. ii. p. 300.

(*d*) Edinburgh Medic. and Surg. Journal, vol. xvi. p. 348.—Langenbeck, in his Neuer Bibliothek für Chirurgie und Ophthalmologie, vol. iii. p. 269, pl. i. f. 2, pl. ii. f. i.

(*e*) Manec, above cited, pl. iv.

(*f*) Leçons Orales, vol. iv. p. 530.

[The operation of tying the subclavian artery above the collar-bone was first attempted by **Astley Cooper** in the spring of 1809, but "the aneurysm was very large, and the clavicle was thrust upwards by the tumour, so as to make it impossible to pass a ligature under the artery, without incurring the risk of including some of the nerves of the axillary *plexus*. The attempt was therefore abandoned" (*a*). The operation was first performed in St. Bartholomew's Hospital, *Nov.* 2, 1809, by **Ramsden** (*b*), for axillary aneurysm about half the size of a large orange. He first made a transverse cut through the skin upon the collar-bone, two and a half inches long, from the outer border of the *m. trapezius*, to within half an inch of the outer edge of the *m. sterno-mastoideus ;* and then pinching up the skin above the bone, he divided it, from within, outwards and upwards, in the line of the outer edge of the sterno-mastoid muscle to the extent of two inches. His object in pinching up the skin for the second cut "was to expose at once the superficial veins, and by dissecting them carefully from the cellular membrane, to place them out of the way without wounding them." (p. 282.) He then dissected with his knife till he had brought into sight "the anterior *scalenus* muscle immediately below the angle which is formed by the traversing belly of the *m. omo-hyoideus*, and the edge of the *m. sterno-cleido-mastoideus ;* and having placed his finger on the artery, at the point where it presents itself between the *scaleni*, he found no difficulty in tracing it without touching any of the nerves, to the lower edge of the upper rib, at which part he detached it with his finger-nail for the purpose of applying the ligature." (p. 283.) Various kinds of instruments, fixed in handles, were essayed in vain to pass the ligature, which was at last managed with a flexible probe, the end of which being introduced behind the artery, was drawn out with the forceps, and the operation completed with a single ligature. The patient died after five days. The subclavian artery was next tied by Sir **William Blizard**, in 1811, in the London Hospital, but the patient died on the fourth day; by **Thomas Blizard**, in 1815, but death followed on the eighth day (*c*); in the same year, by Dr. **Colles**, of Dublin, but the man died on the eighth day (*d*); The first successful case was that of Dr. **Post**, of New York, who operated on *Sept.* 8, 1817 ; the aneurysmal tumour burst on the *ninth* day, and discharged above three ounces of blood ; the ligature came away on the *eighteenth* day (*e*). The second successful case was **Liston**'s, in which the operation was performed on *April* 3, 1820 ; the ligature came away on the twelfth day (*f*). Since this time favourable results have frequently followed ligature of the artery at this part, by English Surgeons, **Gibbs** of St. Petersburg, **Bullen** of Lynn, **Wishart** of Edinburgh, **Green** at St. Thomas's, twice, **Key** and **Bransby Cooper**, each at Guy's Hospital, and **Hobart** of Cork.

Green, in his operations, made a similar cut above the collar-bone, with its concavity upwards, and the inner end higher than the outer ; and, in the case referred to at *page* 224, the external jugular vein being in the way, he put two ligatures upon it, about an inch above the collar-bone, and divided between them, which gave much additional room. To avoid the difficulty often experienced in passing the ligature round the artery, instead of using the common aneurysmal needle, either with or without a handle, and which difficulty appears to arise from the too great length of the curve of the needle, he employed a needle, the curve of which, in size and shape, nearly resembled an ordinary button-hook, and with this the ligature was readily passed round the vessel.

In taking up the artery care should be taken that the ligature be not passed round one of the nerves instead of the artery : this mistake occurred to both **Liston** and **Green**, but was quickly discovered and corrected. An occurrence like this happening to such able and excellent Surgeons will show the necessity of extreme caution before tightening the ligature. I recollect also having seen, on one occasion, the posterior scapular artery, as it crossed the space between the sterno-mastoid and trapezial muscles, being mistaken for the subclavian, and tied, but this mistake was quickly discovered, and the subclavian immediately found and tied.—J. F. S.]

1454. If the aneurysm be situated in the subclavian artery itself, *tying that artery on the tracheal side of the m. scalenus* may, perhaps, give hope of a cure. This operation must, however, always be considered as extremely dangerous and hazardous, if it be remembered with what important structures the artery is connected. The pneumo-gastric and phrenic nerves lie before it, the lower cervical ganglion and sympathetic nerves behind it;

(*a*) London Medical Review, vol. ii. p. 300.

(*b*) Practical Observations on the Sclerocele, &c. ; to which are added four Cases of Operation for Aneurisms. London, 1811. 8vo.

(*c*) Hodgson, above cited, p. 596.

(*d*) Edin. Med. and Surg. Journ., vol. xi. p. 1.

(*e*) Med.-Chir. Trans., vol. ix. p. 185.

(*f*) Edinb. Med. and Surg. Journ., vol. xvi. p. 348.

on the right side, the recurrent laryngeal runs round it, and upon the left, lies between it and the gullet; the subclavian vein lies immediately beneath the collar-bone before the artery, and when distended, even upon it; and it rests immediately upon the *pleura*, which, in carrying round the needle, may be easily wounded. If the ligature be applied in the neighbourhood of the origin of the inferior thyroideal, internal mammary, and vertebral artery, the formation of a plug is prevented, and secondary bleeding ensues (*a*). It is also to be further remembered, that aneurysm of the *aorta*, or of the *arteria innominata*, frequently rises so much above the collar-bone (1), that it may be easily mistaken for subclavian aneurysm (*b*). A. Cooper, Colles, Arendt, Mott, and Hayden, have performed this operation, but not successfully in any case.

The proceeding in this operation is as follows:—A cut three inches in length is to be made through the skin, and *m. platysma myoides*, immediately above the sternal end of the collar-bone; a director should be passed under the clavicular origin of the sterno-mastoid muscle, which is to be divided from the bone, or according to Hodgson and Arendt, the sternal origin also. The cellular tissue is then to be divided with the finger, or with the handle of a knife, till the tracheal edge of the *m. scalenus anticus* is reached, behind which the artery is felt passing. It will be advisable to draw the artery forth, so that the ligature may be applied beneath the origin of the inferior thyroideal and vertebral arteries. When the artery is surrounded by the aneurysmal needle, very great care must be taken not to wound the *pleura*, nor to include any other structure.

Dietrich (*c*) has proposed a modification of King's operation for the right and left side. Upon the *right* side a cut is to be made from the middle of the semi-lunar notch in the top of the breast-bone upwards, directly in the middle line of the windpipe. He then penetrates, in the same way as he proceeds in tying the *arteria innominata*, into the interspace between the two sterno-hyoideal muscles, till he comes to the bifurcation of the subclavian artery. The sterno-hyoideal and sterno-thyroideal arteries are now to be drawn outwards with a blunt hook, and the sheath of the artery carefully slit up, till the pneumo-gastric nerve and internal jugular vein be seen descending immediately before the artery. Upon the *left* side, a cut is to be made on the inner edge of the sterno-mastoid muscle, a line from it, nearer the windpipe, which shall extend for two and a half inches up, along its inner edge, but so, that it is always a line's breadth distant from it. A transverse cut of half an inch, is then to divide the skin and sterno-mastoid muscle. The cellular tissue in the wound is to be carefully divided, any irregular vein, if cut through, to be tied, and the divided sternal portion of the sterno-mastoid muscle drawn towards the left shoulder, with a blunt hook, by an assistant. The outer edge of the sterno-thyroid muscle now appearing, the cellular tissue connecting the underlying parts is now to be somewhat loosened, and drawn by an assistant towards the right side. The carotid artery then appears in the wound, the internal jugular vein in its outer side, and the pneumo-gastric nerve between them. In the lower part of the wound, opposite the base of the breast-bone, behind, and to the outer side of the carotid, lies the subclavian artery. The internal jugular vein is now to be carefully separated from the pneumo-gastric nerve and carotid artery, and drawn back with a blunt hook towards the shoulder by an assistant, who also draws the sternal portion of the muscle in the same direction. The subclavian artery, enclosed in its thick cellular sheath, now becomes visible; its branches, the inferior thyroideal, transverse cervical, vertebral, and internal mammary, are given off somewhat above. The thoracic duct, which here forms its curvature, lies on the inner edge of the sheath of the artery, and also behind the carotid. The artery is now to be somewhat isolated with the handle of the scalpel, the sheath opened on the outside with a careful stroke of the knife by which injury of the thoracic duct is best avoided, and then with a curved blunt hook the ligature should be carried round the artery from behind forwards, and from above downwards.

(*a*) Hodgson, above cited, p. 381.

(*b*) Burns, A., above cited, p. 30.

(*c*) Above cited, p. 43.

[(1) In reference to this most important point it may be mentioned, that there are in the Museum at St. Thomas's Hospital two preparations. The one, an aneurysm of the arch of the *aorta*, involving part of the *arteria innominata*, and mistaken for carotid aneurism; a parallel instance to Allan Burns's case. The other, an aneurysm from the curvature between the origins of the left carotid and subclavian arteries, which communicated by a narrow canal with a large bag in the neck, and having the carotid artery behind it. The latter was the case to which Astley Cooper referred, when advising Burns to be cautious in undertaking a proposed operation for a pulsating tumour above the clavicle, which was at first thought to be a subclavian aneurysm. In the Museum at Fort Pitt, Chatham, there is a preparation of an aneurysm as large as a walnut between the origins of the *arteria innominata* and left carotid. And also another, bounded by the brachio-cephalic trunks in front, the sac of which is deeply indented by the *arteria innominata*.—J. F. S.]

1455. Allan Burns (*a*) and Hodgson (1) proposed *tying the arteria innominata*, and showed, by injecting the dead body, that the circulation can be supported after the obliteration, and that on the subject, the operation can be performed without great difficulty, if the head be bent back, the sternal portion of the sterno-mastoid, sterno-thyroid and hyoid muscles be separated, and the artery followed to its origin. Mott (*b*), Graefe (*c*), Arendt (*d*), Hall (*e*), Bujalsky, Bland, and Lizars (*f*), have performed this operation on the living subject, but not successfully.

In Mott's case, the patient died on the twenty-sixth day, in Graefe's, on the sixty-seventh, and in Arendt's, on the eighth day; in the two former cases from repeated bleeding, and in the third, in consequence of severe inflammation of the aneurysmal sac, of the *pleura*, and lung. Mott, beginning from the aneurysmal swelling, made a cut above the collar-bone, lengthened it to that bone, and continued it on the windpipe, above the upper end of the breast-bone. From thence he made a second cut of about the same length, and carried it along the inner edge of the sterno-mastoid muscle. He then separated the skin from the *m. platysma myoides* beneath it, cut through the latter, and carefully separated the sternal part of the sterno-mastoid muscle in the direction of the former cut. The internal jugular vein, which had adhered to the swelling, was now separated, the sterno-hyoid, and sterno-thyroid muscles cut through, and turned back over the air-tube. The carotid now laid bare for some lines above the breast-bone, was separated from the pneumo-gastric nerve, and the internal jugular vein, which were drawn to the outer side. He now exposed the subclavian artery, in which he particularly used the handle of the scalpel, and a small narrow knife, with a rounded cutting end. In this way he penetrated to the division of the *arteria innominata*, following it under the breast-bone, freed it with the handle of the knife from all the surrounding cellular tissue, and after drawing the recurrent and phrenic nerve aside, he applied a round silk thread around the artery, about half an inch above its division.

Graefe makes an incision on the inner edge of the sterno-mastoid muscle two inches long, and continues it two inches downwards upon the first portion of the breast-bone. He then separates the lips of the wound with blunt hooks, and passes the fore-finger of his left hand, between the sternal part of the sterno-mastoid and sterno-hyoid muscles, not further than the top of the breast-bone, separating the cellular tissue up to the

(*a*) Burns, above cited, p. 31.

(*b*) Medic. and Surg. Register of New York, 1818, vol. i. p. 8.—von Graefe und von Walther's Journal, vol. iii. pt. iv. p. 569.

(*c*) Journal above cited, and vol. iv. pt. iv. p. 587.

(*d*) Vermischte Abhandlungen aus dem Gebiete der Heilkunde von einer Gesellschaft praktischen Aerzte zu St. Petersburg. Samml. iv. 1830, p. 188.

(*e*) Baltimore Medic. and Surg. Journal and Review. Oct. 1833, p. 133.

(*f*) Lancet, 1836-7, vol. ii. p. 445, p. 602.

carotid artery. The patient's head is to be then bent much backwards by an assistant, and the operator carries his finger down along the carotid. Having reached the inner surface of the top of the breast-bone, he finds a blue swelling, under which his finger must be introduced. With the aid of his finger, and the handle of the scalpel, he proceeds down to the place where the *arteria innominata* divides into the carotid and subclavian arteries. Then continues for half an inch farther down, takes the hook, armed with a thread, in the right hand, passes it close to the finger of the left hand, down to the *arteria innominata*, and carrying it round it, draws the threads, and applies GRAEFE's ligature-apparatus.

MOTT used the instruments employed by PARISH, HARTSHORNE, and HEWSON (*a*), which he recommends as sufficient for tying deep arteries. He carries a blunt-ended needle, having two eyes at the two ends, with a needle-holder, around the artery, carefully avoids the *pleura*, then introduces a hook into the eye of the needle, which is brought into view, with which, after freeing the needle-holder, he draws the needle out, and with it the ligature, which is then to be gradually drawn together and tied with two single knots. No effect upon the heart or lungs was noticed.

[(1) CHELIUS is mistaken as regards HODGSON on this point, for he neither proposed nor advised this operation. He merely quotes the operation proposed by BURNS, and as to his opinion of it he observes :—" The ligature of the *arteria innominata*, or of the subclavian artery, on the tracheal side of the *scalenus*, must be regarded as peculiarly hazardous. I have thought it proper, however, to treat of these operations, because, under particular circumstances, a Surgeon may conceive it his duty to undertake them." (p. 384.)—J. F. S.]

1456. Besides these operations performed on living subjects, BUJALSKY, KING, DIETRICH, and MANEC, have proposed other methods for tying the *arteria innominata*.

According to BUJALSKY, the cut through the skin should be made on the inner edge of the sternal portion of the sterno-mastoid muscle, between it and the windpipe, as long as the breadth of four fingers, a little to the inner side of the muscle above, commencing at the middle of the neck, and extending down to the middle of the notch of the breast-bone. The fibres of the *m. platysma myoides* are now apparent at the upper angle of the wound, but at the lower, there is a considerable quantity of fat. The cut is to be continued deeper, and in the middle of the wound the sterno-hyoid muscle is exposed, and to be cut through obliquely; beneath it is the sterno-thyroid muscle, which is also to be divided. The operator should keep as much as posssible to the inner edge, because the internal jugular vein runs along the outer edge. The inferior thyroideal vein, which in the wound passes obliquely under the muscles, is to be drawn upwards or downwards. Sufficient depth having now been attained, the artery is to be isolated and tied.

In KING's (or, rather, O'CONNELL's) mode, a cut from fifteen to eighteen lines long is to be made on the inner edge of the sterno-mastoid muscle of the *left side*, through the skin, *m. platysma myoides* and *fascia* of the neck; the finger is then passed between the sterno-thyroid muscles, and under the right of those muscles, the cervical *fascia* divided, the finger introduced beneath it, and carried down to the *arteria innominata* lying upon it.

DIETRICH has correctly shown the impracticability of KING's operation, and proposes the following. The patient's head should be bent a little backwards, and a cut of from two and a half to three inches long, according as the neck is longer or shorter, and more or less fat, should be made

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(*a*) Eclect. Repos., vol. iii. p. 229.

from the middle of the base of the breast-bone directly upwards, in the mesial line of the windpipe. After dividing the cellular tissue and *fascia*, several little veins appear, enclosed in loose cellular covering; these may very easily be put aside, as they run in the same direction as the windpipe, and terminate in a large vein, which is visible at the lower angle of the wound. The cellular tissue is to be removed, and now the internal cervical *fascia* appears; on both sides lie the sterno-hyoideal muscles, separated by an interspace of two or three lines, and the *fascia* occupying it being cut through, the windpipe is reached. With a blunt hook the right sterno-hyoid, and sterno-thyroid muscles, are to be drawn outwards, which exposes the second inferior thyroideal vein, in the bottom of the wound, sometimes considerably expanded. If it be of the usual size, the point of the scalpel should be carried on its outer side, and the fatty cellular tissue carefully divided, the handle of the scalpel carried downwards, and so the *arteria innominata* reached. But if this vein be considerably enlarged, it must be got under from within outwards, and the cellular tissue in that way divided; this, however, must only be done with the handle of the knife, as otherwise there is no safety against wounding it, which is here of the greatest importance, as this vessel empties itself into the *vena cava descendens*, and, if wounded, severe bleeding would occur from the reflux of the blood. The hook is to be carried under the artery from left to right.

Manec (*a*) directs the head of the patient to be bent much backwards, so that the neck shall be greatly stretched, and the vessel to be tied brought up to the upper edge of the breast-bone; and the face is to be inclined a little towards the left shoulder. A cut of three inches' length is to be made from the middle of the space dividing the two sterno-mastoid muscles, towards the right shoulder, half an inch above the collar-bone, through the skin and *m. platysma myoides;* in the same direction the sterno-mastoid muscle is to be divided, and a director having been passed under the sterno-hyoid and sterno-thyroid muscles, they also are to be divided. For isolating the artery, the operator uses only the handle of the knife. If the inferior thyroideal vein, and some fibres of the hypoglossal and first cervical nerve require division, this must be done with the knife. The artery is to be isolated at its outer and back part with great care, so as not to injure the *pleura*. After this is done, Deschamps' needle should be introduced from the outside, between the pneumo-gastric nerve and the *pleura*, carried out upon the other side between the artery and the windpipe, and the ligature then drawn in.

1457. When the entire trunk of the subclavian artery is obliterated, the blood flows from the superior thyroideal and occipital arteries, into the inferior thyroideal, cervical, transverse scapular, and numerous anastomoses, which spread over the neck and shoulder, into the subscapular, supra-scapular, and posterior-scapular arteries, from which it passses into the trunk of the brachial artery. If the obliteration be at the lower end of the subclavian, or at the axillary artery, the passage of the blood is much more ready, as it is carried by the anastomoses of the cervivical, transverse cervical, and transverse scapular arteries, with the branches of the subscapular and posterior-scapular into the brachial artery (1). That in many cases, after tying the axillary artery for a wound, the sensation and nourishment of the arm are injured, depends not on the

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(*a*) Above cited, pl. ii.

too small flow of blood, but on the injury of the *plexus* of nerves, caused by the wound, or by the tying (2).

(1) The following is the account of the mode in which the circulation was maintained in a case of axillary aneurysm, for which KEY had tied the subclavian artery twelve years previously (*a*); the circumstances of which had been already described (*b*). "The subclavian trunk had undergone no material alteration in size from its origin to the point where the ligature had been applied, just on the outer edge of the *scalenus* muscle. Here the vessel became suddenly obliterated, assuming the form of a dense flattened cord, which was continued for about two inches and a half into the *axilla*, and terminated in the remains of the aneurismal sac. The precise spot where the artery had been tied was clearly indicated by a deep indentation; but the continuity of the vessel above the ligature with the obliterated portion below it, was not destroyed, or, more properly speaking, had been restored, after the separation of the silk, by a process of adhesion, which connected the two extremities to each other, and glued them to the contiguous structures. The aneurismal sac still existed in the *axilla*, where it formed a firm and solid, but at the same time somewhat elastic and yielding tumour about the size of a small hen's egg, * * * and presented a smooth uniform exterior, bearing altogether considerable resemblance to those cysts which are occasionally found to form themselves around foreign bodies. The obliterated portion of the axillary trunk terminated in the upper and back part of the sac; while, from its under surface, the continuation of the artery was seen to emerge as a perfect vessel; having been restored to nearly its natural calibre by the entrance of a large branch, which was originally given off immediately below the tumour, and through which the blood had afterwards assumed a retrograde course. On opening the sac, the coats of which were remarkably dense and hard, it was found to contain a firm and solid ,coagulum, which readily separated from the surrounding cyst, and on being removed, retained the precise shape of the tumour. A section of it clearly evinced that it consisted of fibrin, apparently inorganized, dense and tough in its texture, and of a dirty-yellowish colour." The anastomosing vessels consisted of three sets :—"1. A posterior set, consisting of the suprascapular and posterior scapular branches of the subclavian, which anastomosed with the infrascapular from the axillary. 2. An internal set, produced by the connexion of the internal mammary on the one hand, with the long thoracic arteries and the infrascapular on the other. 3. A middle or axillary set, which consisted of a number of small vessels derived from branches of the subclavian above, and passing through the *axilla* to terminate either in the main trunk, or some of the branches of the axillary below. This last set presented, most conspicuously, the peculiar character of newly-formed, or rather dilated, arteries. They were excessively tortuous and formed a complete *plexus*, which was almost inseparably connected with the axillary nerves; many of the branches penetrating into the midst of the nervous fibres, so as to render their separation a work of great difficulty and labour. The chief agent in the restoration of the axillary trunk below the tumour was the infrascapular artery, which communicated most freely with the internal mammary, suprascapular, and posterior scapular branches of the subclavian; from all of which it received so great an influx of blood, as to dilate it to three times its natural size. The infrascapular artery was, in this subject, given off much higher than usual; and its origin had been included in the aneurismal dilatation; in fact the artery opened into the sac itself; and, under the restored state of the circulation, the blood had to traverse a small portion of the cavity in order to reach the commencement of the axillary trunk. The continuity between the two vessels had been preserved through the *coagulum* contained in the tumour, which, for a short space, actually constituted the arterial coats; thus, when the contents were removed, the injected wax became exposed at the bottom of the cyst; while a corresponding deep *sulcus* in the *coagulum* indicated the channel through which the blood had passed. The suprascapular artery was, in this instance, given off by the superficial cervical, and became augmented just as it reached the *scapula*, by a branch which arose from the obliterated portion of the main trunk, but which had again been rendered available, as a medium of circulation, by receiving a vessel from the subclavian above. The common origin of the short thoracic and humeral-thoracic arteries had become obliterated as it came off from the sac itself; but the two vessels had subsequently regained their original size; the one being supplied by its connexion with the internal mammary, the other by communications with the superficial cervical." (p. 63–5.)] This preparation is in Guy's Hospital Museum.

(*a*) Guy's Hospital Reports, vol. i. 1836. (*b*) Med.-Chir. Trans., vol. xiii. p. 1. 1827.

(2) Not only do weakness and numbness occur when the axillary nerves are injured, but even gangrene has happened in the case mentioned by White, of Manchester (a), in which three of the nerves were tied in, and in Desault's case (b), in which the whole axillary *plexus* was included in the ligature.—J. F. S.]

1458. The tying of two branches of the subclavian artery, to wit, the internal mammary, and the vertebral artery have yet to be mentioned.

1459. The *internal mammary artery may be tied* without much difficulty in the second, third, or fourth intercostal space; in the first, its nearer position to the edge of the breast-bone renders its tying more difficult. In either of the just-named intercostal spaces, a cut made from the edge of the breast-bone, and on the upper edge of the lower rib, is carried outwards, and a little upwards towards the lower edge of the upper rib, so that its whole extent occupies an inch and a half, and by its termination, just below the under edge of the upper rib, it is secured from injuring the intercostal artery. The skin, cellular tissue, and *aponeurosis* of the great pectoral muscle are to be divided, and also the muscle itself. There still appear some layers of cellular tissue, and beneath them the *ligamenta nitentia;* these are to be divided with some slight strokes of the knife, as well also as some fibres of the intercostal muscles hereupon seen, with which usually a small arterial branch is cut through, and must be at once tied. A thin layer of cellular tissue still covering the artery is now to be carefully divided, the artery isolated from the accompanying vein, and a needle carried round it, from within outwards. In the third and fourth interspace the artery lies upon the fibrous expansion of the *m. triangularis sterni;* so that, in carrying round the needle, there is no fear of wounding the *pleura* (c).

Velpeau's practice of making a cut three inches long, parallel to the side edge of the breast-bone, and which must be deepened to get at the artery, is unfitting. On the contrary, I have very frequently found the artery by a cut, commencing on the side edge of the breast-bone, and running directly in the middle of the costal interspace, more frequently than in the way just described.

1460. For the possible case of *tying the vertebral artery*, Dietrich (d) has proposed two modes of treatment, according as the artery is to be looked for between the *atlas* and dentate *vertebra*, or between the *atlas* and occipital bone.

In the *former* case, the head of the patient being inclined to the opposite side, and a little forwards, a cut is to be made two fingers' breadth from the lobe of the ear, or one finger, behind the mastoid process, beginning half an inch above the latter, and carried for two inches along the outer hinder edge of the sterno-mastoid muscle. From the upper fourth of the length of this cut, a second is to be carried backwards, and obliquely downwards, to the extent of an inch. After dividing the skin, some cellular tissue appears in both cuts, which should be divided, and then in the first is seen the outer and hinder edge of the sterno-mastoid muscle; and in the second, the *m. splenius* covered with aponeurotic expansion. The wound is now to be deepened, through the aponeurotic and cellular tissue, and in the second cut the fibres of the *m. splenius* are to be divided, at which time a small artery will be wounded. After the division of this muscle a second aponeurotic layer appears, which must be divided with some light strokes of the knife, and under it pass some branches of arteries and nerves. An assistant with blunt hooks holds the edges of the wound apart, and now a layer of fat appears, in which the vertebral artery is enveloped. At the same time also the outer edge of the *m. obliquus capitis inferior* is seen at the inner edge of the second wound, and is to be drawn somewhat inwards. Two branches of the occipital artery, also enclosed in cellular tissue, pass across the wound. The cellular tissue is now to be divided with the handle of the knife, and the arterial branches drawn upwards or downwards. Two branches of the second cervical nerve also now show themselves, and are to be drawn up or down out of their place; after which the isolation of the artery is no longer prevented. This done, the needle is to be carried round the artery from without inwards, in order more certainly to avoid the internal carotid artery, which lies very near the vertebral, and is only separated from it by cellular membrane.

(a) London Medical Journal, vol. iv. p. 159.

(b) Œuvres Chirurgicales, vol. ii. p. 553.

(c) Dietrich, above cited, p. 89.

(d) Ibid., p. 81.

If the vertebral artery be tied between the *atlas* and *occiput*, the cut should be made, as in the former case; but the first is to be begun a quarter of an inch above the mastoid process, by which the second cut, which, in like manner, passes from the upper fourth of the length of the former backwards and obliquely downwards, runs somewhat more upwards. After cutting through the skin, *fascia*, and *m. splenius*, the occipital artery appears in the upper angle of the first wound, as also at the front edge on the upper fourth, the hind edge of the *m. obliquus capitis superior;* but in the whole surface of the wound a layer of *aponeurosis*, and under it cellular tissue, loaded with fat, the former of which must be carefully divided. The edges of the wound are now to be held asunder with blunt hooks by an assistant, and then a triangle appears, formed by the *m. rectus capitis posterior*, and *m. obliquus capitis superior* and *inferior*, filled with fat and cellular tissue, which covers the artery. This is then to be carefully divided, turned back, and, if in large quantity, should be partially removed, upon which the artery appears below the *m. obliquus capitis superior*, and runs backwards nearly an inch before it perforates the occipito-atlantal ligament. The vessel is then to be isolated, and the ligature, by the aid of a ligature-needle, passed obliquely from below upwards, for the purpose of more surely avoiding the nerves and vein.

NUNTIANTE IPPOLITO, who saw two cases of aneurysm of the vertebral artery, has proposed the following mode of tying it. After having found the triangular space formed by the external jugular vein, the hind edge of the sterno-mastoid muscle, and the upper edge of the collar-bone, a cut is to be made through the skin, from its top to the base, not exceeding two inches in length. The operator continues penetrating in this direction till he reach the inner edge of the *m. scalenus anticus*, and thus the artery is easily struck upon, without injuring one twig of a nerve (*a*).

MÖBUS (*b*) mentions a case of aneurysm of the vertebral artery, originating in wound which was cured by compression, the application of ice, and so on.

[An example of this very rare disease (aneurysm of the vertebral artery) has recently occurred in the Northern Infirmary at Liverpool; the carotid artery could be distinctly traced over the pulsating swelling, of the actual nature of which there were some doubts, as to what kind of aneurysm it was, or whether only a pulsating tumour. It was decided to tie the common carotid artery. The tumour rapidly increased after the operation, and in about a fortnight the patient died by bursting of the aneurysm into the trachea. On *examination*, an aneurysm of the vertebral artery, between the transverse processes of the fourth and fifth cervical *vertebræ* was found.—J. F. S.]

Upon the importance of tying the vertebral arteries, and its greater danger in comparison with tying the carotid arteries in animals, see ASTLEY COOPER (*c*).

[The arteries of the brain sometimes become affected with aneurysm. In the Museum of the Royal College of Surgeons, there is an example of a small conical aneurysm in the anterior cerebral artery.—J. F. S.]

(*a*) FRORIEP'S Notizen, 1835. p. 304.

(*b*) VON GRAEFE und VON WALTHER'S Journal, vol. xiv. p. 98.

(*c*) Some Experiments and Observations on tying the Carotid and Vertebral Arteries, and the Pneumo-gastric, Phrenic and Sympathetic Nerves; in GUY'S Hospital Reports, vol. i. p. 457, and p. 654

III.—OF ANEURYSM OF THE BRACHIAL, ULNAR, AND RADIAL ARTERIES.

1461. Aneurysms of the brachial artery, and its branches, are almost always consequent on wounds, and occur most frequently at the bend of the arm, after a wound of the artery in bleeding. In these aneurysms therefore compression is commonly employed with the best results.

[" I do not recollect," says Astley Cooper, " to have seen a case of aneurysm from disease in the brachial artery." (p. 78.) Hodgson observes:—" I have never seen an aneurysm in the arm which was not produced by accidental violence." (p. 389.) Liston (*a*) also speaks of the rarity of spontaneous aneurysm at the bend of the elbow; and says:—" I have treated but one such case in the person of an old ship's-carpenter. While at work, as usual, he felt something snap in his arm, a pulsating tumour was soon after noticed, and it had attained, during four months, fully the size of a hen's egg, and was evidently, in part, made up of solid matter. The brachial artery was tied, and every thing went on favourably." (p. 181.)]

1462. If the aneurysm be seated in the trunk of the brachial artery, at the bend of the arm, or in the ulnar (1), radial (2), or interosseal artery near the bend, it is sufficient to tie the brachial artery (*b*). But if it be situated in the middle of the fore-arm, in the region of the wrist, it is necessary to tie the artery near the aneurysmal sac, because the free anastomosis on the back of the hand, is sufficient to support the aneurysm by the reflux of the blood (*c*).

The free anastomosis of the arteries of the arm always renders it advisable to undertake tying the artery near the sac, because in many cases the regurgitation of the blood continues the growth of the sac, and causes its bursting (*par.* 1423.) In an aneurysm originating from wound of the artery, in the middle of the arm, when the sac does not extend far upwards, the opening of the sac is to be effected according to Hunter's first plan.

[(1) Astley Cooper had seen " only one case of aneurism of the ulnar artery from disease; it was seated where the artery dips under the *pronator radii teres* and flexor muscles of the hand." The artery was tied above the swelling with great difficulty, and " the patient died from the constitutional irritation resulting from this operation." (p. 81.)

(2) Liston says he has " secured the radial and ulnar arteries in all parts of their course for small aneurysms." (p. 187.) In the College Museum there is a preparation of aneurysm of the radial artery an inch above the origin of the superficial volar branch. Astley Cooper mentions a case in which William Cooper, formerly Surgeon at Guy's Hospital, " in performing this operation, (tying the radial artery,) found the upper portion of the radial artery obliterated, and that the aneurism was supported by regurgitation from the hand, from the free anastomosis with the ulnar artery." (p. 81.)]

1463. In aneurysm upon the back or front of the hand, tying one or other of the large arteries of the fore-arm does not, on account of the extensive communications which the ulnar and radial arteries have with each other in the hand, prevent the blood flowing back with sufficient power to keep up the aneurysm. If in this case pressure be insufficient for curing the aneurysm, the sac must be opened, and the artery tied above and below; and if this be not possible, one of the principal arteries of the fore-arm must be tied, the sac opened, and the bleeding arrested by pressure. The same rules must be followed in wounds of the arteries of the fore-arm and hand (*d*).

1464. The brachial artery may be tied in any part of its course, from the arm-pit to the bend of the elbow. Its tying, therefore, must be con-

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(*a*) Practical Surgery, 1838. Second Edit. 8vo.

(*b*) Scarpa, above cited, p. 384.—Roux, Nouveaux Elémens de Médecine Opératoire, vol. i. pt. ii. p. 759.—Hodgson, above cited, p. 393.—Walther, above cited, p. 58.

(*c*) Hodgson, above cited, p. 394.

(*d*) Scarpa, above cited, p. 407.

sidered, *first*, at the end of the axillary artery, where it passes beneath the lower edge of the great pectoral muscle; *second*, in the middle of the upper arm; and *third*, at the elbow-joint.

1465. If the artery be to be *tied in the arm-pit*, the arm must be separated from the trunk, and the fingers carried along the inner edge of *m. biceps* into the arm-pit, for the purpose of ascertaining the course of the muscle, and the position of the artery. A cut is then to be made along the inner edge of the *m. biceps*, of two inches in length, which is to extend upwards to the middle of the neck of the upper arm-bone. The skin first and then the *aponeurosis* is to be divided, with a careful cut; or the latter is first raised with the forceps, and cut into with the bistoury held flat, so as to admit a director, upon which it is to be divided. The edges of the wound are now to be separated with blunt hooks from each other, when the inner edge of the *m. coraco-brachialis* and *biceps*, together with the median nerve, are now seen, and behind the latter lies the artery. The nerve is drawn carefully inwards, and the artery which is between it and the edge of the just-mentioned muscles isolated, and the needle carried carefully around it, so as not to include the internal cutaneous nerve.

If the operator keep on the inner edges of the *m. biceps* and *coraco-brachialis*, in the manner recommended, and draw the median nerve inwards, there is no danger of erring, which may easily be done if he keep somewhat more inwards, where the radial or ulnar nerve are met with; and if one of these be mistaken for the median, the artery will be sought in vain. The following is the relative position of the artery:—The artery is separated from the edge of the *m. biceps* and *coraco-brachialis* only by the median nerve; on its inner side is the internal cutaneous nerve, and these two nerves at once cover the front of the artery. Near the cutaneous nerve lies the vein, which frequently forms two or three branches, and these render the isolation of the artery difficult. Still further inwards lie the radial and ulnar nerves.

1466. In order to tie the brachial artery *in the middle of the upper arm*, a cut, two and a half inches long, is made through the skin, along the inner edge of the *m. biceps*. The aponeurotic expansion is then to be divided, and the artery is found on the inner edge of the just-named muscle covered with the median nerve, between its two accompanying veins. The edge of the *m. biceps* is to be taken hold of, and the median nerve drawn somewhat inwards, between which and the edge of the muscle the artery appears, and is easily isolated with the handle of a knife; the ligature is to be carried round it with DESCHAMPS' needle.

The brachial artery frequently divides high up. If the ulnar artery be given off high up, it is always observed to penetrate the *fascia* of the upper arm, and take a superficial course. If the radial originate high up, it for the most part accompanies the ulnar artery to the elbow-joint, and then separates from it (*a*). TIEDEMANN (*b*), who has very often noticed the high division of the brachial artery in the corpse, found in such cases the radial artery nearly always very superficial at the elbow-joint, immediately under the aponeurotic expansion, from the *aponeurosis* of the *m. biceps*; on which account it is very easily wounded, but can also be as easily tied. The ulnar artery lies beneath this *aponeurosis* of the *m. biceps*. If, on laying bare the brachial artery, two arteries are found, they must be alternately compressed, in order to ascertain whether the pulsation in the aneurysm be stopped, for the purpose of tying that one in which it is seated.

1467. To tie the brachial artery *at the bend of the arm*, a cut two inches long is to be made through the skin on the extended arm, in the direction of a line imagined to be drawn from the middle, between the

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(*a*) HODGSON, above cited, p. 391.

(*b*) WALTHER, above cited, p. 63. Tabulæ Arteriarum, pl. xiv. xv.

two condyles of the upper arm-bone, obliquely inwards and upwards towards the inner edge of the *m. biceps*. The veins lying beneath the skin are to be avoided, the superficial *aponeurosis* of the *m. biceps* is to be opened without or with a director introduced, and the artery isolated, for which purpose the fore-arm should be somewhat bent.

The median nerve here lies upon the inside of the artery three or four lines distant from it; the median basilic vein lies sometimes upon, sometimes at the side of, and frequently beneath the artery; and farther outward is the median cephalic vein.

1468. To *lay bare the radial artery in the upper third of the fore-arm*, a cut should be made, about two inches long, through the skin, a little below the insertion of the tendon of the *m. biceps*, in the oblique direction of the ulnar edge of the *m. supinator longus*. The *aponeurosis* of the fore-arm is to be divided in the same direction, and the edge of the just-mentioned muscle inclined somewhat outwards, when the artery appears in the interspace between it and the *m. flexor carpi radialis*. A branch of the musculo-cutaneous nerve lies upon the outer side of the artery, which is accompanied by one or two veins.

In *laying bare the ulnar artery in the upper third of the fore-arm*, a cut two inches and a half long is to be made between the radial edge of the *m. flexor carpi ulnaris*, and the *m. flexor digitorum sublimis*, through the skin and *aponeurosis* of the fore-arm. The artery lies rather under the edge of the *m. flexor digitorum sublimis*, accompanied by a vein, and on its outer side by the ulnar nerve.

In *the lower part of the fore-arm*, where these arteries are quite superficial, they are very easily laid bare. With the radial artery the cut falls on the radial side of the tendon of the *m. flexor carpi radialis;* with the ulnar artery between the tendons of the *m. flexor carpi ulnaris* and *flexor sublimis digitorum.*

If the *ulnar artery be tied in the region of the wrist*, a cut an inch and a half long, and three or four lines to the outside of the pisiform bone, should be made through the skin and fatty cellular tissue, which often fills up the whole wound, and, in such case, must be in part removed. The ulnar nerve is now found opposite the pisiform bone, and to its outer side the ulnar artery, accompanied by two veins. The artery should be isolated, and the ligature applied above the origin of its hinder branch which anastomoses with the deep palmar arch.

To *tie the end of the radial artery*, the hand must be brought prone, and bent somewhat towards the fore-arm. A cut is to be made from the outside of the styloid process of the spoke-bone, to the upper part of the interspace separating the first and second metacarpal bones. After cutting through the skin, the veins coming into view are to be drawn outwards or inwards, and the delicate branches of nerves which cross the wound divided. The position of the tendons of the *m. extensor longus* and *brevis pollicis* is now to be ascertained, and between them, and towards the most depending part of the *carpus*, a kind of soft and thick *aponeurosis*, which covers this part, is to be divided. Beneath it are some little masses of fat, which, if in the way, are to be removed, and then upon the carpal bones a thin aponeurotic layer is seen, which allows the artery, with its accompanying veins, to show through. This layer is then divided upon the director, and the artery easily isolated (*a*).

(*a*) MANEC, above cited, pl. vii. viii.

1469. The supply of blood to the arm, after tying the brachial artery, is effected by the branches of the *arteria profunda humeri*, and the anastomoses of the recurrent radial, ulnar, and interosseal arteries. If the brachial be tied above the origin of the *arteria profunda*, the blood flows through the ramifications of the circumflex humeral and subscapular arteries, into the ascending branches of the *arteria profunda*, and the recurrent radial and ulnar arteries.

[WHITE, of Manchester (*a*), has given a beautiful engraving of the circulating branches fourteen years after the brachial artery had been tied just above the bend of the elbow, for a wound in bleeding.

In the Museum at St. Thomas's Hospital are two beautiful preparations of the anastomotic branches enlarged after the brachial artery had been tied. In the one a long portion of the artery had been obliterated, and sets of vessels are descending on either side from above the obliteration, to be received into others which ascend in similar manner from below it. In the other the obliteration is less extensive, and a single curved artery about as big as a crow-quill passes from the upper to the lower open part of the artery.—J. F. S.]

IV.—OF ANEURYSM OF THE EXTERNAL AND INTERNAL ILIAC ARTERY.

1470. ASTLEY COOPER (*b*), in an aneurysm which extended four inches above and as many below POUPART's ligament, and had burst, undertook to *tie the abdominal aorta*. For this purpose he made a cut into the white line three inches in length, in the middle of which was the navel, which, by a curve in the wound, was placed on its left side, and then a small opening made into the *peritonæum*, which was lengthened with a button-ended bistoury to the extent of the external wound. He then passed his finger between the intestines, down to the spine, scratched with his nail through the *peritonæum* on the left side, carried his finger gradually between the spine and *aorta*, and then passed a single ligature with a blunt aneurysmal needle around it. The ligature was carefully tied without including intestine, and the wound brought together with the quill suture and sticking plaster. The patient died forty hours after the operation; sensation and warmth had, however, returned on the thigh of the healthy side, but that of the diseased side was cold and bluish.

JAMES (*c*), on account of an aneurysm of the external iliac artery, first tied the femoral, according to DESAULT's and BRASDOR's proposal; and the aneurysm at first diminished a little, but soon increased. He then proceeded to tie the abdominal *aorta* as ASTLEY COOPER had done, only that he began his cut in the white line an inch above, and terminated it two inches below the navel. The patient died the same evening.

MURRAY (*d*) tied the *aorta* on account of a very extensive iliac aneurysm. He made a cut through the skin and muscles, beginning from the jutting extremity of the tenth rib, and continuing it about six inches down, curving in a direction backwards to an inch from the upper front spine of the hip-bone. He divided the transverse *fascia* on a director, separated with his hand, carried in flat, the *peritonæum* from the sheath of the *m. iliacus internus* and *psoas*, and easily reached the *aorta*. Passing the finger between the spine and *aorta* was more difficult, as also was the separation of the nervous *plexus* and the sheath of the *aorta*, which he

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(*a*) Cases in Surgery, p. 139. London, 1770. 8vo.

(*b*) His and TRAVERS' Surgical Essays, vol. i. pt. i. p. 393.

(*c*) Medico-Chirurgical Trans., vol. xvi. p. 1.

(*d*) London Medical Gazette, vol. xiv. p. 68, 1834.

effected partly with his nail, and partly with an elevator. Passing the aneurysmal needle was also very difficult. Drawing the ligature together did not excite any pain. The patient lived twenty-three hours after the operation.

It may be more convenient, as recommended by Astley Cooper, in tying the abdominal *aorta*, to make the cut about an inch distant from the epigastric artery, outwards, and running parallel to it, and to proceed as in tying the internal iliac artery.

According to Guthrie's recent views, it is in no case necessary to tie the *aorta*, because in an aneurysm of the external or internal iliac, the common iliac on the diseased side can always be got at, and if not there, yet on the healthy side, for the purpose of carrying a ligature around it.

[The *aorta* was also tied by C. D. Monteiro (*a*) at Rio Janeiro, *Aug.* 5, 1842, for an aneurysm of the femoral artery, close to the groin, which on examination turned out to be spurious, by the vessel having burst and formed a large swelling, occupying a great portion of the right under part of the belly. The incision was made on the left side, from the tip of the last false rib to the upper front iliac spine, through the abdominal walls, avoiding the *peritonæum.* The fingers were then carried down to the *aorta*, and a ligature with great difficulty passed around it by means of a ligature-needle. But little blood was lost. As soon as the ligature was tied, the aneurysm sunk down, but the artery swelled up (?), and for some time remained as a thick large knot. The case went on well till the *eighth* day; at three, P.M., arterial blood escaped through the dressings; it did not, however, affect the pulse, but patient's countenance was sunken and hollow. The bleeding continued, and on the *tenth* day, at 10 A.M., he died. The ligature had been placed two lines above the bifurcation of the *aorta ;* a small opening was found on the left side of the vessel, immediately above the ligature.]

1471. If an aneurysm be situated on the external or internal iliac artery, or if it have extended so far upwards that there is not sufficient space between the aneurysm and the origin of these arteries to apply a ligature, tying the common iliac artery is indicated. Gibson (*b*) tied this artery for a wound; Mott (*c*) on account of an aneurysm of the internal iliac artery, Crampton (*d*) and Salamon (*e*) on account of a large external iliac aneurysm; Liston for secondary hæmorrhage; Guthrie for a presumed aneurysm of the gluteal artery; also Syme, Deguise, and Peace (*f*); but Mott's, Salamon's, Deguise's, and Peace's operations alone were successful.

1472. In order to *tie the common iliac artery*, an imaginary line must be drawn from the upper front spine of the hip-bone directly towards the white line: two and a half inches above this line, and two lines from the outer edge of the *m. rectus abdominis*, a cut should be begun, carried obliquely downwards and outwards, and terminated an inch and a half below the line, so that it has a length of from four to five inches. In this direction, the skin, the *fascia* of the external oblique muscle, the muscle itself, and then the *fascia* of the internal oblique muscle, are cut through; the transverse muscle with its *aponeurosis* is then divided with some careful strokes of the knife, or a director is introduced, and they are divided upon it. Any spouting vessel must be tied; the edges of the wound drawn asunder with blunt hooks by an assistant, and with the finger passed down into the wound, or with the handle of the knife, the cellular connexion of the *peritonæum* with the surrounding external parts must be divided. The patient's trunk is then to be inclined towards the healthy side, so that the intestines may drop away from the wound, and

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(*a*) From a letter of Lallement's ; in Schmidt's Jahrbücher der in und ausländischen gesammten Medecin. Jahrgang, 1843. Leipz.

(*b*) American Medic. and Surg. Recorder, 1820, vol. iii. p. 185.

(*c*) American Journal of Medical Sciences, vol. i. p. 156, 1827.

(*d*) London Medical and Surgical Journal, vol. v. p. 382.

(*e*) Froriep's Notizen, vol. iv. No. 3, 1837.

(*f*) Dublin Journal of Medical Science, vol. xxiii. p. 214, 1843, extracted from the Philadelphia Medical Examiner.

the division of the outer and under parts be facilitated. If there be not any diseased thickening, the separation is easy; but if there be, the bistoury must be used with the greatest care. The *peritonæum* with the *ureter* is now to be borne upwards, and being kept in that position with a spatula, by an assistant, the finger is to be carried down to the artery, which lies in a position corresponding with the cut. Below the artery and a little inwards, the accompanying vein lies; and at the lower angle of the wound pass branches of the ilio-lumbar artery and veins. The sheath of the artery must be torn with the nail of the forefinger, or with the handle of the scalpel, according as it is thinner or thicker; the artery is then isolated, and the needle carried round it, whilst the vein is pressed inwards (*a*).

Mott made a cut, five inches long, beginning immediately above the external abdominal ring, and continued in a semi-lunar direction half an inch above Poupart's ligament, to a little above the front spine of the hip-bone; he then divided the external and internal oblique and transverse muscles, and separated the *peritonæum* from its cellular connexions.

Crampton carried a cut, seven inches long, from the seventh rib, downwards and forwards, to the front spine of the hip-bone, in a semicircular form, with its concavity towards the navel, cut through the three abdominal muscles, and separated the *peritonæum.*

According to Anderson (*b*), the cut should be commenced from the upper and front spine of the hip-bone, half an inch above Poupart's ligament, parallel with it, continued towards the share-bone, and curved somewhat upwards, so that it is four inches long; cutting through the three abdominal muscles, and so on.

Salamon made a cut about an inch from the upper front spine of the hip-bone, proceeding at similar height from it, and in parallel direction to the epigastric artery, terminating about a finger's breadth below the last false rib, and from four to four and a half inches long. The division of the abdominal muscles and transversal *fascia*, and so on.

1473. If an aneurysm be situated on a branch of the internal iliac artery, to wit, on the ischiatic or gluteal artery, tying the internal iliac is indicated, as the practice followed by J. Bell (*c*) in a case of ischiatic aneurysm arising from injury, viz., opening the sac and tying the artery above and below the wound is extremely dangerous, and only in few cases can be permissible. W. Stevens (*d*) tied the internal iliac artery for an aneurysm above the ischiatic notch; J. Atkinson (*e*) on account of a gluteal aneurysm, so also White (*f*); Mott (*g*), for a gluteal or ischiatic aneurysm. Atkinson's and Mott's cases were unfortunate, but the other two had the happiest result (1).

[(1) The internal iliac artery has also been tied successfully by a Russian army-Surgeon (*h*); also by my friend Thomas, of Barbadoes, but the patient died, and the preparation is in Guy's Museum (*i*).]

1474. To *tie the internal iliac artery*, a cut of five inches in length is to be made through the skin and three muscles, upon the under and outer side of the belly, parallel to the course of the epigastric artery, and an inch to its outer side. The exposed *peritonæum* is to be separated with the finger from the *m. iliacus internus* and *psoas magnus*, and the finger carried down to the internal iliac artery, which should be detached by it from its connexions; and about half an inch below its origin a ligature is to be carried round it with an aneurysmal needle.

(*a*) Dietrich, above cited, p. 288.
(*b*) System of Surgical Anatomy, p. 1.
(*c*) Principles of Surgery, vol. i. p. 421.
(*d*) Medic.-Chir. Trans. vol. v. p. 422.
(*e*) London Medical and Phys. Journal, vol. xxxviii. 1816.
(*f*) American Journal of Medical Sciences, vol. i. p. 304. 1828.
(*g*) Ibid., vol. xx. p. 1, 1837.
(*h*) Averill's Operative Surgery, p. 79.
(*i*) Med.-Chir. Trans., vol. xvi. p. 230.

In this way STEVENS proceeded, and this operation is most proper and safe. WHITE made a semicircular cut seven inches long, beginning two inches from the navel, and continuing it nearly down to the external inguinal ring.

According to ANDERSON and BUJALSKY, the cut should be begun a finger's breadth above the upper front spine of the hip-bone, or even higher, and half an inch distant from POUPART's ligament, but continued parallel to it for about three inches towards the share-bone. Cutting through the three abdominal muscles, separation of the *peritonæum* and retracting it together with the spermatic cord upwards.

[The following are the particulars of OWEN's dissection (*a*) of STEVENS' case. The woman died ten years after the internal iliac artery had been tied. The internal iliac artery had become impervious at the part where the ligature had been applied, and "the ilio-lumbar appears to have arisen just above this point, the obliteration in consequence had not extended to the origin of the external iliac. In the state of a ligamentous cord, the internal iliac descended towards the ischiatic notch for the space of an inch, and then suddenly resuming its natural diameter it again became pervious, and so continued for the extent of half an inch; the glutæal artery arising from the lower part of this space; a sacro-lateral vessel from about the middle; and the obturator artery from the upper part of it. The latter vessel was, however, entirely obliterated, but the sacro-lateral artery was pervious, of the size of a crow quill, and passed inwards to the second sacral *foramen*; whilst the glutæal artery, of its natural size, received close to its origin two vessels as large as the preceding, given off from the sacro-lateral artery, near the third and fourth sacral *foramina* of the left side. The anastomoses of the sacro-lateral arteries with each other and the sacro-median were large and tortuous. Immediately after the origin of the glutæal artery, the ischiatic, obliterated and cord-like, passed on to the lower part of the ischiatic notch; the sanatory processes set on foot by the application of the ligature being uninterrupted by the enfeebled current of blood passing from small canals to a large one. Many vessels met with in the course of the dissection of the *glutæus maximus* and *medius* were found to have received the injection. The glutæal artery was in a healthy condition, and of the natural size; but an elongated tumour, situated between the tuberosity of the *ischium* and the great *trochanter* indicated the true seat of the original disease. This tumour in length three inches and a half, and above two-thirds of an inch in breadth, was of the sciatic artery, and consisted of layers of condensed cellular membrane and the peculiar fibrous arterial coat. It contained a quantity of dark-coloured granular not lamellated coagulum, which, when removed, showed the internal surface of the sac to be somewhat irregular and raised in small patches by the deposition of soft matter. In some places it appeared to retain the smooth character of the arterial lining membrane. From the ischiatic notch to the tumour, the artery was completely obliterated, its texture altered and the remains of the cavity filled with indurated and partly calcareous matter. From the lower part of the tumour the sciatic artery was continued down the posterior part of the thigh of an uncommon size, nearly as large as the femoral artery in front; its calibre did not, however, correspond with the apparent magnitude, for its coats were thicker, by at least one-half than any artery of the same size with itself. It was obliterated for about the space of an inch below the sac, and became pervious after receiving an anastomosing vessel from the *arteria profunda.* A vessel ramifying between the *glutæus maximus* and *medius*, and distributing branches to these muscles, was connected to the commencement of the sac, from which it had probably arisen; it did not, however, open into the sac, but after becoming contracted near the point of attachment, it there gave off a small artery to the *quadratus femoris* and received its blood by anastomosing near the *crista ilii*, with a superficial branch of the glutæal artery. A smaller vessel was similarly attached to the lower part of the aneurysmal sac, but neither did it communicate with that cavity, for the blood which it received from branches ramifying in the neighbourhood was diverted from the sac by a small branch given off at the point of attachment." (p. 222–25.)]

1475. If *the gluteal artery is to be tied*, a cut three inches long should be made through the skin and cellular tissue, commencing at the upper hinder spine of the hip-bone, and carried in the direction of the fibres of the great gluteal muscle, towards the great *trochanter*. The fibres of the great and middle gluteal muscles are to be divided in the same direction, to the lower edge of the hip-bone and the artery found.

CARMICHAEL (*b*) tied the gluteal artery, for spurious aneurysm, by a penknife wound

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(*a*) Med.-Chir. Trans. vol. xvi.

(*b*) Dublin Journ., vol. iv. p. 231, 1833.

in the way just directed. From one to two pounds of coagulated blood were emptied out. The vessel could not be taken up with the tenaculum; but a ligature, with a large common needle, having been passed round it, was tied, and came away in six days. The boy was convalescent in sixteen days.

To *tie the ischiatic artery*, a cut two and a half inches long must be made through the skin and cellular tissue, commencing immediately below the under hind spine of the hip-bone, and continued along the fibres of the great gluteal muscle, towards the outside of the tuberosity of the haunch-bone, where it is connected with the rump-bone, and the artery is found lying on the ischio-sacral ligament (*a*).

1476. If *the common pudic artery is to be tied*, a cut of an inch or an inch and a half long should be made along the inside of the descending branch of the haunch-bone, through the skin, cellular tissue, *fascia* of the great gluteal muscle, and through the muscle itself. The edges of the wound are to be kept asunder with blunt hooks, by which a layer of fat is exposed, and beneath it lies the artery. This is to be divided, or partially removed till the *m. erector penis* be laid bare, on the inner side of which muscle lies the vessel, accompanied by two veins and a branch of the pudic nerve. The transverse perinæal artery also accompanies the pudic, running almost parallel with it. The artery is to be carefully isolated, and the needle carried round it, from within outwards (*b*).

[In the Museum of the Royal College of Surgeons there is an example of aneurysm of the pudic artery an inch in diameter, and nearly filled with clot. Whilst alive, the patient had a strongly pulsating tumour under the left great gluteal muscle; he was much out of health, and died. On *examination*, there was found beneath the hinder edge of the muscle a tumour, as large as a walnut, upon the ischiatic notch, and adhering to the ischiatic nerve as it left the *pelvis*. The artery was the internal pudic, and it was healthy above till it at once dilated into an aneurysm, below which it was obliterated, so that there was no outlet for the blood: the coats were strong like the coats of many encysted tumours.—J. F. S.]

V.—OF ANEURYSM OF THE FEMORAL AND POPLITEAL ARTERIES, AND THEIR BRANCHES.

1477. Abernethy (*c*) was the first who tied the external iliac artery in the groin for aneurysm. This case, although not successful, showed the possibility of the limb being sufficiently supplied with blood after obliteration of the artery.

[The first time Abernethy tied the external iliac artery was in the early part of the year 1796, on a patient in St. Bartholomew's Hospital who had popliteal aneurysm in one, and femoral aneurysm in the other leg. The femoral artery was tied for the cure of the former by Sir Charles Blicke with two ligatures, between which it was divided; the upper ligature came away on the tenth and the lower on the fifteenth day, and the cure was perfected. "About five weeks after this operation, the aneurism in the opposite thigh was almost ready to burst, the tumour having acquired a pyramidal form, and the skin covering the apex having yielded so much as to form a kind of process from the tumour. Indeed, the integuments at this part were so thin, that we every hour expected them to give way. The aneurism was situated so high, as to make it probable that the disease extended above the place where the *arteria profunda* is sent off," and prevented pressure being made upon the artery, except at the place for incision; but even here it did not stop the pulsation, and troublesome bleeding occurred during the operation. A small opening made in the *fascia* of the thigh admitted the finger, upon which it was divided up to Poupart's ligament, and down to the sac. The pulsation directed the finger and thumb to the artery, which was tied with two ligatures,

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(*a*) Zang, Operationslehre. Third Edition, vol. i. p. 203.

(*b*) Dietrich, above cited, p. 244.

(*c*) On Aneurysms; in the Medical and Physical Journal, vol. vii. p. 97, 1802, and in his Surgical Works, vol. i. p. 254. The first case here mentioned is cited from the latter, and the second from the former work.—J. F. S.

the upper half an inch from the *os pubis*, and the lower the same distance from the *arteria profunda*, but the artery was not divided between them. "The tumour diminished greatly after the operation, and the blood contained in it became coagulated, which it did not appear to have been before the operation." * * * Every thing went off well till the fifteenth day, when the upper ligature separated, and the blood gushed in a full stream from the open extremity of the vessel. The bleeding was stopped by pressure. The stream of blood which flowed upon any remission or wrong application of the pressure was so large that we did not dare to remove the patient even from the bed on which he lay. Mr. Ramsden undertook, in this situation, to prevent the further escape of blood from the vessel, whilst I proceeded to tie the artery above Poupart's ligament. Accordingly, I first made an incision, about three inches in length, through the integuments of the *abdomen*, in the direction of the artery, and thus laid bare the *aponeurosis* of the external oblique muscle, which I next divided from its connexion with Poupart's ligament, in the direction of the external wound, for the extent of about two inches. The margin of the internal oblique and *transversalis* muscles being thus exposed, I introduced my finger beneath them for the protection of the *peritonæum*, and then divided them. Next with my hand I pushed the *peritonæum* and its contents upwards and inwards, and took hold of the external iliac artery with my finger and thumb, so that I was enabled to command the flow of blood from the wound. It now only remained that I should pass a ligature round the artery and tie it; but this required caution, on account of the contiguity of the vein to the artery. I could not see the vessels, but I made a separation between them with my fingers. Having, however, only a common needle with which to pass the ligature, I several times withdrew the point from apprehension of wounding the vein. After having tied the artery about an inch and a half above Poupart's ligament, I divided that part, and thus laid bare ithe new and the former wound into one. * * * No adhesion took place between the divided parts; the edges of the wound were open and sloughy. * * * Still no greater mischief appeared till the fifth day after the operation, when a hæmorrhage of arterial blood took place in such quantity that there was no doubt but that it arose from the principal artery, though the ligature with which it was tied still remained firm." No further attempt at tying the vessel higher up was made, but compresses were fixed with a bandage, and continued for three days, but there was still occasional, though not profuse bleeding. "In the course of the eighth day after the last operation he died." On *examination*, it was found, that, "for nearly two inches above the part which was tied, the lymphatic glands covering the artery were considerably enlarged. The external surface of one of them next the wound had ulcerated, and the ulceration penetrated through the gland, and communicated with the artery. * * * The ulcerated opening from the artery, through the diseased gland, admitted the passage of a moderate-sized bougie." (p. 254–66.) Abernethy remarks:—"In this case I thought I disturbed the *peritonæum* too much, and tied the artery higher than was necessary." (p. 269.) This accordingly he avoided in his second operation on the 24th of October, 1801, and having divided the edges of the internal oblique and transversal muscles, "I now introduced," says he, "my finger beneath the bag of the *peritonæum*, and carried it upwards by the side of the *psoas* muscle, so as to touch the artery about two inches above Poupart's ligament. I took care to disturb the *peritonæum* as little as possible, detaching it to no greater extent than would serve to admit my two fingers to touch the vessel." (p. 99.) The artery was then tied with two ligatures and divided between. He went on tolerably till the fifth day when "the wound and contiguous parts looked remarkably well, but a bloody sanies was discharged which I felt unable to account for. On the sixth day the state of his health and limb continued as well, if not improving. The bloody discharge, however, had increased in quantity, insomuch that it ran through the coverings of the wound and soiled the bed; it had also become fœtid. * * * I could not believe that a healthy wound would secrete such a sanies, and I felt apprehensive lest the wound should spread from disease. Nothing, however, took place to confirm this idea. It seemed probable, also, that if the aneurysmal sac were not entire, some of the blood being exposed to the air, might tinge the discharge from the wound and grow putrid. I frequently pressed on the tumour, but could press no blood from the wound." On the ninth day he "appeared like a man advanced in typhus fever. * * * On examining the wound, with a view to discover the cause of this great and sudden alteration, and pressing on the tumour beneath Poupart's ligament, I forced out a great quantity of blood rendered fluid and highly fœtid by putrefaction." He continued slowly sinking, and died "on the twenty-third day after the operation. A few days before his death both ligatures came away with the dressings." On *examination*, it was found that "the *peritonæum* was separated from the loins, and from the posterior half of the left side of the *diaphragm*, by a considerable collection of blood which extended below to POUPART's ligament, and communicated under that ligament with the aneurysmal sac This opening was situated in the direction of that crevice which is found between the internal iliac and *psoas* muscle. The only rational explanation that can be given of the formation of this collection is, that the blood had burst its way from the aneurysmal sac in the vacancy between the muscles just mentioned, after which it would readily and extensively separate the *peritonæum* in the manner described. * * * The extremities of the external iliac artery, which had been divided in the operation, were united together by a fine newly-formed substance; the sides of each extremity were perfectly closed, and a small plug of coagulated blood was found in each. * * * It seems evident that, in the present instance, the operation was too long delayed. It would be desirable in future to perform the operation before an extensive diffusion of blood had taken place; indeed, could the adequateness of the collateral arteries for the supply of the limb be established, it would be proper to operate before the artery had burst." (p. 101-104.) ABERNETHY's third case operated on the 11th of October, 1806, on which the ligatures came away,—the lower on the fifth, and the upper on the fourteenth day,—succeeded, as did also his fourth on the 25th of February, 1809, in which the ligatures came away on the tenth day. ABERNETHY's case was not, however, the first successful one as on the 4th of October, 1806, FREER (*a*) tied the external iliac artery with a single ligature, which came away on the sixteenth day, just anticipated ABERNETHY's by five days. Within the year, TOMLINSON of Birmingham also successfully tied the same vessel with a single ligature, which separated on the twenty-sixth day. ASTLEY COOPER's first case, also successful, is most important of all, though not performed till the 22nd of June, 1808, as he had the opportunity on the patient's death, 18 years after, of examining the condition of the tied vessel and of the anastomosing arteries.

Both external iliac arteries have been taken up in the same subject at the interval of a week, in one instance by TAIT (*b*), and in the other by ARENDT (*c*), and did well.]

1478. Tying the *external iliac artery* is not merely indicated in aneurysms above the *arteria profunda femoris*, but also in those below the origin of that artery, which extend so close to POUPART's ligament, that there is no space for the operation between it and the aneurysm; which practice is certainly preferable to opening the sac, with compression of the femoral artery on the horizontal branch of the share-bone, in order to avoid the *arteria profunda.*

1479. The *external iliac artery is to be tied* in the following manner. The patient being placed on a couch with his buttocks somewhat raised, the operator stands on the side on which the operation is to be performed, and makes a cut through the skin and cellular tissue, commencing half an inch to the inside of the upper front spine of the hip-bone, and terminating at the middle of POUPART's ligament. The cut should be continued in the same direction, through the *aponeurosis* of the external oblique muscle, the muscular fibres of the internal oblique muscle, and with the greatest care through the thin *aponeurosis* of the transverse muscle, so as not to wound the *peritonæum*. The exposed *peritonæum* is to be separated with the finger at the lower angle of the wound, from its yielding connexion with the *m. iliacus internus*; and pressing it inwards, the external iliac artery is felt, accompanied on the inside by the vein, and on the outside by the crural nerve. It is then to be isolated with the finger or with the handle of the knife, and the ligature carried round it with DESCHAMPS' needle; this last proceeding can, at least in the dead body, be facilitated by bending the thigh at the hip-joint.

The decisions as to the direction and size of the cut in this operation are very various. They may be arranged in three classes.

1. With a nearly *straight* cut.

ABERNETHY made a cut four inches long, commencing an inch and a half from the upper front spine of the hip-bone, nearer the white line, and carried it down in the

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(*a*) Above cited, p. 80.

(*b*) SAMUEL COOPER's Surgical Dictionary, p. 157.

(*c*) VELPEAU, Nouv. Elémens de Médecine Opératoire, vol. i. p. 175

direction of the external iliac artery to half an inch above Poupart's ligament. He divided first the skin, then the *aponeurosis* of the external oblique abdominal muscle, and carried his finger under the lower edge of the internal oblique and transverse muscles, in order to protect the *peritonæum*, whilst he divided those muscles with a common or button-ended bistoury. The *peritonæum* was pressed back with the finger.

According to Charles Bell, the cut should be commenced at the outer pillar of the abdominal ring, carried outwards and upwards, and terminated half an inch above the upper front spine of the hip-bone, and two fingers' breadth to its inner side. The *aponeurosis* of the external oblique muscle is then to be divided from the ring upwards, upon a director, the lower edge of the internal oblique muscle raised, the spermatic cord drawn inwards and upwards, with a blunt hook, the cellular tissue put aside, and the artery isolated. But if there be not sufficient space to apply the ligature, the internal oblique muscle must be divided upwards and outwards.

Scarpa begins the cut half an inch under the upper front spine of the hip-bone, and an inch and a half from it nearer the white line, and carried down near to the crural arch. Division of the three abdominal muscles and separation of the *peritonæum*.

(2) With a *semilunar* cut.

Astley Cooper makes a semielliptical cut, beginning near the spine of the hip-bone and terminating a little above the inner edge of the outer abdominal ring. The *aponeurosis* of the external oblique is divided in the same direction. This flap being now a little raised, the course of the spermatic cord is seen, and if followed by the finger under the edge of the internal oblique muscle, the opening in the *fascia transversalis* (inner ring) is entered, and the finger touches the artery (4).

The practice of Lisfranc and Anderson agrees with this, but the latter makes the cut less curved and a little shorter, (not quite three inches,) separates the skin upwards and downwards, and dividing the *aponeurosis* of the external oblique muscle, terminates the cut a little before the external abdominal ring. The *aponeurosis* is then to be separated from the internal oblique muscle, with the handle of the knife: the spermatic cord now exposed, is to be raised, and its sheath lifted up and cut through with the knife or scissors. Through this aperture the little finger of the right hand is to be carried to the internal ring, and the artery being reached, is then to be separated from the iliac *fascia* and vein by the introduction of a silver aneurysmal needle, and tied.

Rust considers that the cut should be made in the same way, only three and a half inches long, through the three abdominal muscles and the epigastric artery, which must at once be tied.

(3) With an *oblique* incision.

Langenbeck, Delpech, and others, determine that the cut should be commenced two fingers' breadth from the upper front spine of the hip-bone, and continued across towards the *m. rectus* a finger's breadth from Poupart's ligament, so that the cut should be four fingers broad. The division of the three abdominal muscles and so on.

Wright and Post (*a*), in case of an aneurysm extending high up, made a cut four inches long, from the upper end of the swelling, to a point, between the navel and the upper front spine of the hip bone. The *peritonæum* much thickened by the pressure of the swelling needed cutting. Bujalsky also makes the incision in the same direction.

Compare Dietrich (*b*) on the preference and objections to these different operations.

[(4) Upon Cooper's mode of tying the external iliac Guthrie observes :—"It offers the advantage of greater space, which enables the Surgeon to see better what he is doing; but it does not so readily admit of the artery being tied high up, without an additional incision being made in a direction different from the first, which is after all a matter of no consequence, if it were found necessary to do it." (p. 375). He also mentions that he "has seen the epigastric artery divided in this operation.* * * If the Surgeon has unluckily divided it, either in this or in any other operation, all that he has to do is to enlarge the incision and tie both the divided ends; and I have no hesitation in saying it will not be of any consequence, either in this operation or in one for *hernia*. If a man has been so unfortunate as to have a wound in his *peritonæum* of a quarter or of half an inch in extent, two ligatures on the epigastric artery, and a slight increase on the extent of the external incisions, add little or nothing to the danger, which only takes place in reality when the wound is closed up, and the artery is allowed to bleed internally." (p. 376.) Dupuytren did not, however, find this to be exactly the case when he divided the epigastric artery in 1821; the bleeding was very copious, and though he stopped it by putting on two ligatures, the patient died in a few days of *peritonitis* (*c*).]

1480. If there be room *beneath* Poupart's *ligament to apply a ligature around the femoral artery*, a cut is to be made midway between the iliac

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(*a*) American Med. and Phil. Register, vol. iv. p. 443.

(*b*) Above cited, p. 284.

(*c*) Averill's Operative Surgery, p. 73.

spine and pubic *symphysis*, beginning at the edge of POUPART's ligament, and continued somewhat obliquely from above downwards. The skin and underlying fat are to be divided, the glands separated, and the superficial layer of the *fascia lata* divided, where the artery is found in the canal formed by the two layers of that *fascia*, having the vein on the inner, and the nerves on the outer side.

The femoral artery commonly gives off the *arteria profunda* an inch and a half, or two inches below POUPART's ligament; but it frequently arises before the femoral artery has passed under POUPART's ligament. For this reason the direction to begin the cut an inch below POUPART's ligament is improper, because here, manifestly, although the cut may be several inches long, yet the space is too confined for isolating the artery.

TEXTOR and ROBERT FRORIEP make a cut two and a half inches long, half an inch below POUPART's ligament, and parallel to its lower edge, so that it corresponds to the middle of the femoral ring. In the same direction the cellular tissue and *fascia* are to be divided upon a director, in doing which the director is only to be introduced a short distance, and the division to extend three lines from the two edges of the wound.

1481. The vessels by which the circulation is kept up, after tying the external iliac artery, are the anastomoses, between the gluteal, ischiatic, internal pudic, and obturator, with the circumflex arteries, which arise from the deep artery, from the external pudic, epigastric, and circumflex iliac arteries. If the obturator arise from the epigastric, a large quantity of blood passes through its anastomosis with the internal pudic and ischiatic, and the branches of the circumflex artery of the thigh. The epigastric and circumflex iliac artery also convey blood by their anastomoses with the internal mammary, with the intercostal, lumbar, and sacral arteries. If, therefore, the aneurysm be below the epigastric artery, there may be, after the obliteration of the external iliac artery, a flow of blood above the seat of aneurysm into the artery, but no enlargement of the aneurysm from it is to be feared (1).

There are a considerable number of cases in which the external iliac artery has been tied. Fifteen out of twenty-two have been (according to HODGSON) cured; a very good proportion, if it be remembered that many of the patients had been already much weakened by previous bleeding from the sac (*a*).

[MOTT (*b*) tied the external iliac artery fourteen days after tying the femoral of he other limb; in both on account of aneurysm. The case did well.

The following are the principal points in the dissections of three of the cases in which ASTLEY COOPER tied the external iliac artery.

In the case (*c*), which died ten weeks and six days after the operation, "it was found that the femoral, tibial, and fibular arteries were still open, and that the blood was conveyed into the femoral artery by the following anastomoses. The internal pudendal artery formed several large branches upon the side of the bulb of the *penis*, and these branches freely communicating with the external pudendal artery had determined the blood into that artery, and by this channel into the femoral; the lateral sacral artery also sent a branch on the *iliacus internus* muscle, into the femoral artery, and the ilio-lumbar artery freely communicated with the *circumflexa ilii;* so that, by these three routes, the blood found direct ingress to the femoral artery. Numerous branches of arteries also passed from the lateral sacral to the obturator and epigastric arteries, the obturator in this case having its origin from the epigastric. Besides these arteries, a free communication existed between the *arteria profunda* and circumflex arteries, with the branches of the internal iliac; first, the gluteal artery sent a branch under the *glutæus medius* muscle to the external circumflex artery; secondly, the ischiatic artery gave two sets of branches of communication, one upon the *glutæus maximus* muscle to the *arteria profunda*, and another upon the sciatic nerve to the internal circumflex artery; the internal pudendal artery also sent a branch of communication to the internal circumflex; lastly, the obturator freely communicated with the internal circumflex." (pp. 428, 29.)

In COOPER's second case (*d*), "examined, at three years after tying the external iliac artery," the external iliac and the femoral arteries were obliterated, excepting about an inch of the femoral artery, just below POUPART's ligament, which still remained open,

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(*a*) HODGSON, above cited, p. 416. (*b*) American Journal of Medical Sciences, vol. i. p. 483.
(*c*) Med.-Chir. Trans., vol. iv. 1813. (*d*) Ibid.

and continued to convey a portion of the blood; but, below this part, it had become simply a ligamentous cord. The internal iliac artery sent first a very large artery of communication to the epigastric and obturator artery, so that the epigastric was supplied with blood from the internal iliac; secondly, the internal iliac sent an artery of communication upon the sciatic nerve, to the internal circumflex artery. The gluteal artery gave a large branch to the origin of the *profunda;* lastly, the internal pudendal artery largely anastomosed with the obturator; the obturator, therefore, sprang in this case from two new sources, viz. from the internal iliac, and from the internal pudendal artery, and the obturator thus formed sent two branches of communication to the internal circumflex artery. The *arteria profunda* was in this case supplied from two sources directly from the gluteal, and more indirectly from the internal circumflex, by the obturator and ischiatic arteries. The external iliac artery was obliterated to the origin of the internal iliac, as other arteries usually are when ligatures are made upon them to the first large anastomosing vessel. The principal agents then of the new circulation are the gluteal artery with the external circumflex, the obturator artery with the internal circumflex, and the ischiatic with the *arteria profunda*, and the obturator artery is supplied with blood principally by the internal pudendal when the obturator arises from the epigastric artery." (p. 429–31.) Both preparations are in St. Thomas's Museum.

In Cooper's third case (*a*), eighteen years after the operation, "the external iliac artery was pervious to the extent of rather more than an inch from the bifurcation of the common iliac, but had become somewhat diminished in size, and altered in shape. No branches were given off from this portion of the vessel, which, when filled with injection, presented a conical form, tapering downward to a mere point, and terminating in a rounded cord which constituted the remaining part, or the obliterated portion of the artery, and was continued down to the spot where the operation had been performed. The ligature had probably been applied just above the origin of the circumflex and epigastric branches, although no evidence remained to indicate the precise spot. Just above Poupart's ligament the iliac artery became suddenly restored, (apparently by the influx of blood from the branches mentioned above,) and assumed about half its natural size. The obliterated vessel presented the appearance of a continuous unbroken cord, from the cessation of the iliac above to its restoration below. * * * The vessel having regained about half its natural size, passed into the thigh and was continued without receiving any accession from collateral vessels, until it reached the origin of the *profunda;* from which branch the trunk appeared to derive a large quantity of blood, sufficient to restore it to the ordinary extent of calibre which the femoral possesses in a stout muscular limb; the remaining portion of the femoral artery below the *profunda* presented nothing unusual in its appearance, and bore no indication of having received any further influx of blood through collateral branches. Just above the origin of the *profunda*, the femoral artery had become distorted, and irregular in shape, and was rendered somewhat obscure by its connexion with what appeared to be the remains of the aneurismal sac adhering to the anterior surface of the vessel and gluing it to the adjacent muscles and *fascia.* There can be but little doubt that the original opening of communication between the sac and the femoral trunk had existed at this spot, viz. just above the *profunda* branch; but it would seem equally apparent that, as the aneurismal tumour became obliterated in the progress of the cure after the operation, the opening into the vessel also became closed, while the integrity of the arterial trunk, above and below the sac, was maintained continuous and entire. The collateral circulation had, in this instance been established by the junction of the ilio-lumbar, obturator, gluteal and ischiatic, branches from the internal iliac, with the circumflex and epigastric of the external iliac and the *profunda* of the femoral. They consisted of three sets of communicating vessels which descended respectively over the fore part, the internal side, and the posterior surface of the hip-joint, and may be described as forming a circular *plexus* around the articulation, ramifying among the muscles of that region. * * * The ilio-lumbar, gluteal, and ischiatic arteries are enormously dilated. The internal pudic is also of large size, but it does not appear to furnish any direct communication with the femoral." (p. 48–50.) This preparation is in the Museum of Guy's Hospital.]

1482. If the aneurysm be situated in the lower third of the thigh, or at the knee-joint, it is best to *tie the femoral artery* in the following manner. The pulse of the artery should be followed from the groin downwards, and where it is only indistinctly felt is to be the end of a cut, which begins about two and a half inches below Poupart's ligament, and descends on

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(*a*) Guy's Hospital Reports, vol. i. 1836.

the inner edge of the *m. sartorius*, in the triangular space formed by the *m. adductor secundus* and *vastus internus*. The skin and *fascia lata* being divided, and the edge of the *m. sartorius* drawn somewhat outwards, the artery is found enclosed in its cellular sheath, with the femoral vein under it, and the branches of the crural nerve on its outer side. When the artery is properly isolated, the ligature is to be carried round it with the aneurysmal needle (*a*).

John Hunter tied the femoral artery in the lower half of the thigh; dividing the skin and *fascia lata* on the inside of the *m. sartorius* to the extent of three inches, he laid bare the edge of this muscle, isolated the artery lying beneath, and tied it near the place where it passes through the tendon of the *m. adductor* (*b*). If the artery be tied in the upper half of the thigh, he thinks it best done at the inner edge of the *m. sartorius*; and if in the lower half, at the outer edge (*c*), which, after having been laid bare by a cut three inches long, is to be drawn somewhat inwards, where the artery is covered with a slip of *aponeurosis*, passing from the *m. adductor* to the *m. vastus internus;* this must be cut through, and the artery isolated in the way already mentioned.

1483. If an aneurysm be in the ham or on the upper part of the arteries of the leg, there may be sufficient space for tying the artery in the ham; but on account of the depth of the vessel, of the difficulty of its isolation, its nearness to the joint, and so on, this operation is to be considered as by far more dangerous and less safe than that of tying the femoral artery. In aneurysms, tying the femoral artery is to be unconditionally preferred, and only in cases of wound of the popliteal artery is its tying indicated, in which sufficient enlargement of the wound is usually necessary. As for the rest, the popliteal artery has been tied in three different parts, at the *middle*, *upper*, and *lower* part of the ham.

1484. If the artery is to be laid bare *in the middle of the ham*, the patient having been placed on his belly, and the thigh perfectly extended, a cut, three inches long, is to be made a little to the inner side of the mesial line of the ham, through the skin and *aponeurosis*, taking care to avoid the *vena saphena;* the edges of the wound being then separated, the Surgeon penetrates deeper with careful cuts, and with the handle of the knife through the cellular tissue, often much loaded with fat, down to the popliteal nerve, vein, or artery itself. The nerve lies on the outer side, and between it and the artery is the vein, which covers the outside of the artery. The nerve should be drawn aside, and the artery separated with the greatest care from the vein, so as to wound neither the articular veins nor arteries. When the needle is to be carried round the artery, the leg must be somewhat bent.

If the artery be tied *in the upper part of the ham*, a cut is to be made somewhat on the inside of the base of the triangular space formed on the inside by the *m. semi-tendinosus* and *semi-membranosus*, and on the outside by the *m. biceps femoris*, to the top of this triangle, the skin and *aponeurosis* are divided, and the rest of the operation performed as in the former case.

In tying the popliteal artery *at the lower part of the ham*, the cut is to be made somewhat on the inside of the mesial line, and some lines below the knee-joint, from three to four inches long, above the hind part of the leg, through the skin, cellular tissue, and *aponeurosis;* the interspace between the two heads of the *m. gastrocnemius* then appearing, these are to be separated, and the trunk of the vessel and the sural branches come into

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(*a*) Scarpa, Translation, p. 278.

(*b*) Transactions of a Society for the Improvement of Medical and Surgical Knowledge, vol. i. p. 148.

(*c*) Caillot, above cited, p. 72.—Wegehausen, in Rust's Magazin für die gesammte Heilkunde, vol. ii. p. 408.

view with the veins and posterior cutaneous nerves of the leg. These parts are to be drawn aside by an assistant, and the cellular tissue being divided with the handle of the knife, the popliteal artery is found on the inner side, the vein in the middle, and the nerve on the outside. If the cut be somewhat lengthened in this proceeding, the posterior tibial artery may be tied at its upper part (*a*).

Jobert (*b*) ties the artery in the internal epicondyloid pit, viz., in the triangular depression bounded within by the *m. sartorius*, *gracilis*, *semi-tendinosus* and *semi-membranosus*. The knee is to be half bent, and a cut made on the outer edge of these muscles, two inches long, through the skin to the fatty tissue. The skin is to be then drawn outwards, and a second cut across the former made, but without wounding the skin, by which the tendinous expansion of the *m. adductor magnus* is divided. The forefinger is to be passed beneath the tendinous expansion, and a button-ended bistoury introduced upon it, to cut through the superficial layer of the *aponeurosis* which covers the artery. The pulsation of the artery is then felt, and in some thin persons may even be seen. The fatty tissue is to be penetrated with a director, which is carried with the greatest care between the artery and vein.

1485. If the aneurysm be situated at the commencement of the tibial artery, the femoral must be tied in the way mentioned (1). But if it be lower on the tibial artery, the inflow of blood, after tying the femoral artery, is sufficient, in large aneurysms of the foot, to keep up the disease, and it is therefore necessary to tie the affected artery in the neighbourhood of the aneurysmal sac (2).

[(1) The following case of aneurysm of the posterior tibial artery is a good example of the practice recommended:—

Case.—M. H., aged 38 years, was admitted,

Sept. 13, 1832, with a pulsating tumour at the back of the upper part of the right leg. He had fallen down stairs a twelvemonth since upon a brush, and at the same time twisted his leg, which laid him up with great pain and swelling for ten days, but after that time he seemed to get well, excepting that he had a little continual pain and always a throbbing behind and below the head of the *fibula*. Six months since, after having walked a considerable distance, his leg began to swell and be so painful as to compel him to keep at rest. There is now distinct pulsation below the head of the fibula and at an opposite point on the inside of the leg beneath the gastrocnemial muscles. The posterior tibial artery does not pulsate at the ankle; and the anterior tibial beats but feebly. The girth of the affected leg at this part is nearly sixteen inches, whilst in the other it is only thirteen and a half inches. The temperature of the limb is diminished; and he has numbness and pricking of the whole limb below the tumour, more particularly affecting the foot. Pressure of the femoral artery at the groin, or on the sides of the swelling, diminishes it half an inch, but it fills immediately, when the pressure is withdrawn.

Sept. 21. My colleague Green tied the femoral artery at the usual place in the middle of the thigh. The pulsation ceased when the ligature was tightened.

Oct. 2. Has been going on well; the limb about an inch smaller, but more yielding: the pricking and numbness of the foot have ceased.

Oct. 30. The ligature came away. After which the wound soon healed; but at two months' end the size of the limb had only diminished an inch.

Astley Cooper mentions a case of "anterior tibial aneurism a little below the head of the fibula, for which the femoral artery was tied; the pulsation ceased in the aneurism, and the swelling for a time subsided. The case did not ultimately recover, for a slough of the aneurismal sac took place." (p. 63.)

(2) The younger Cline had a case of aneurysm of the anterior tibial artery "on the upper part of the foot, and he tied the anterior tibial artery at the lower part of the leg, but the pulsation in the aneurism continued when the boy left the hospital." "It will therefore be right," says Astley Cooper, "to tie the artery by opening the sac. so as to secure it above and below the aperture, if the aneurism be seated low down in the limb, as the anastomosis with the plantar arteries is exceedingly free." (p. 63.)]

(*a*) Bierkowsky, Anatomisch-chirurgische Abbildungen, pl. viii. figs. 1, 2.; pl. x. fig. 3. A, B.—Froriep, R., above cited, pl. xii.—Dietrich, above cited, p. 334.—Manec, above cited, pl. xi.

(*b*) Nouvelle Bibliothèque Médicale, 1827, Feb.

1486. In *laying bare the anterior tibial artery somewhat above the middle of the leg*, the space between the anterior tibial muscle and the long extensor of the great toe, is to be chosen and the great toe moved whilst the finger is carried outwards from the crest of the shin-bone. The skin and *aponeurosis* of the leg are to be divided for two and a half inches in the direction of this space; then with the finger, or with the handle of the knife, these muscles are separated, and at the depth of an inch the anterior tibial artery is found, with its accompanying single vein and nerve.

In the neighbourhood of the instep the artery is quite superficial, covered by the skin and *aponeurosis* of the leg, between the tendons of the *m. tibialis anticus* and *extensor pollicis longus.* If the dorsal artery of the foot is to be laid bare, a cut is made in the direction of the second toe, on the back of the foot, through the skin and *aponeurosis*, and the artery is found between the tendons of the *m. extensor pollicis* and the first tendon of the *m. extensor brevis digitorum.*

1487. The *exposure of the posterior tibial artery in the middle or in the upper third* of the leg is very difficult, on account of its depth and of the expansion of the *aponeurosis* being tightened by the contraction of the muscles of the calf. A cut is made along the inner edge of the shin-bone, for three or four inches through the skin, and the attachment of the *m. soleus* divided throughout the whole of this extent. The muscle must then be turned a little aside, and the aponeurotic expansion, separating the muscles of the calf into a superficial and deep layer, divided, under which the artery is found, between two veins, and accompanied with the tibial nerve on its fibular side (1). *At its lower part* the posterior tibial artery lies very superficial, and may easily be exposed by a cut, two inches long, between the inner ankle and the ACHILLES' tendon. It lies closer to the heel than the tendons of *m. tibialis posticus*, and *flexor digitorum pedis*, and is surrounded with fat and cellular tissue.

[(1) It will not be out of place here to give a caution as to the treatment of a wound of the posterior tibial artery, by any instrument or other body penetrating from the outside of the leg. I well recollect the case of a man, who whilst mowing in company with others, received the point of the scythe of the labourer next behind him, in the outside of the upper part of his leg. The scythe passed inwards, and wounded the posterior tibial artery, without piercing the skin on the inside of the leg. The wound was freely enlarged, and great pains taken to get at the vessel, but its depth was so great, that after many efforts, the attempt was given up. A cut was then made on the inside of the leg, as above directed, and the vessel reached and tied with great ease. In a similar case, the like practice should be adopted. The only difficulty in the operation consists in forgetting that the artery and deep layer of muscles are overspread with a tight *fascia*, which may possibly be mistaken for the interosseous ligament. The artery cannot be reached till this be opened very freely, as it is very unyielding.—J. F. S.]

1488. If the *peroneal artery be tied* in the middle of the leg, a cut is to be made from any one part of the outer side of the ACHILLES' tendon, and carried obliquely upwards and outwards to the hinder outer surface of the splint-bone. The external saphenous vein is to be avoided, the *aponeurosis* divided, and the forefinger, passed before the ACHILLES' tendon, is carried upon it before the muscles of the calf, so as to separate them from the deep layer. The *fascia* covering the deep muscles is to be cut through, and the inner edge of the *m. flexor pollicis* raised upwards and outwards. The artery is found sometimes between the fibres of this muscle, and sometimes between it, the splint-bone, and the interosseous membrane. If the artery be looked for deeper than the middle of the leg, as CHARLES BELL proposes, its hinder branch only is found.

1489. What has been already said about aneurysms on the front and back of the hand, applies also to those on the sole, and on the back of the foot. If here it be not permissible, on account of the position of the aneurysm, to open the sac, and tie the artery above and below, the flow of blood must be prevented by tying the affected artery still higher, and, after opening the sac, it must be completely prevented by pressure. This treatment must also be followed in wounds of arteries on the back of the foot and in the sole (*a*).

1490. When the femoral artery is obliterated at the origin of the *arteria profunda*, the blood passes from the branches of the internal iliac arteries into the circumflex arteries of the thigh, and by the descending branches of the *a. profunda* into the articular arteries, whence it passes into the trunk of the femoral. If the obliteration occur in the lower third, the circulation is kept up, not merely by the anastomosis between the *a. profunda* and the arteries of the knee, but also by many anastomotic or muscular branches. If a part of the popliteal artery, or even the origin of the upper or lower arteries of the knee be obliterated, the blood passes by the anastomosis of the *a. profunda* into the upper, thence into the lower arteries of the knee, and from them into the recurrent branches of the tibial arteries.

[The following is ASTLEY COOPER'S account (*b*) of the dissection of almost seven years after the femoral artery had been tied for popliteal aneurysm. "The femoral artery which is necessarily obliterated by the ligature, was here converted into a cord, from the origin of the *arteria profunda* down to the ham. The whole of the popliteal artery was also changed into a similar substance; and thus the natural channel of the blood from the groin to the lower part of the knee was entirely destroyed. The muscles therefore which usually receive blood vessels from the femoral artery, as the *sartorius*, *rectus* and *vasti*, had no branches but from the *arteria profunda* and circumflex arteries; and the articular arteries from the popliteal, although they were still capable of receiving blood, derived it, not from the popliteal artery, but from the communicating vessels of the *profunda*. The *arteria profunda* formed the new channel for the blood; considerably enlarged in its diameter, although still not equal in size to the femoral artery at the groin, it took its usual course to the back of the thigh on the inner side of the thigh bone, and sent branches of a larger size than usual to the flexor muscles of the leg, and just midway on the back of the thigh it began to send off those arteries which became the support of the new circulation. The first artery sent off passed down close to the back of the thigh-bone, and entered the two superior articular branches of the popliteal artery, which vessels supply the upper part of the knee-joint. The second new large vessel arising from the *profunda* at the same part with the former, passed down by the inner side of the *biceps* muscle, to an artery of the popliteal, which was distributed to the *gastrocnemius* muscle. Whilst a third artery dividing into several branches, passed down with the sciatic nerve behind the knee joint, and some of its branches united themselves with the inferior articular arteries of the popliteal, with some recurrent branches of those arteries, with arteries passing to the *gastrocnemii*, and lastly with the origin of the anterior and posterior tibial arteries; and these new large communicating branches were readily distinguished from others by their tortuous course. It appears then that it is those branches of the *profunda* which accompany the sciatic nerve, that are the principal supporters of the new circulation. They were five in number, besides the two deep seated arteries which do not accompany the nerve. The external circumflex was considerably larger than usual for the supply of branches to the muscles on the fore part of the thigh, but it had no branches for the new circulation. The obturator artery did not appear larger than usual, and although much pains were taken to trace any enlarged communicating branches between the ischiatic arteries and *profunda*, yet no vessels capable of receiving so large an injection could be found." (p. 254–56.)]

(*a*) SCARPA, p. 225.—ROUX, Nouveaux Elémens de Médecine Opératoire, vol. i. pt. ii. p. 698.

(*b*) Med.-Chir. Trans. vol. ii. 1811.

VI.—OF ANEURYSMAL VARIX AND VARICOSE ANEURYSM.

Hunter, Wm., M.D., Medical Observations and Inquiries, vol. i. p. 340, vol. ii. p. 390.

Guattani, De cubiti flexuræ aneurysmatibus; in **Lauth**'s Collectio Scriptorum, &c., p. 203.

Scarpa, above cited, p. 421. Translation.

Hodgson, above cited, p. 496.

Adelmann, P., Tractatus anatomico-chirurgicus de aneurysmate spurio-varicoso. Wirceb., 1821. 4to; with two lithographic plates.

Schottin, Merkwürdiger Fall einer aneurysmatischen Venengeschwulst. Altenburg, 1822.

Breschet, Mémoires chirurgicaux sur différentes espèces d'Anévrysmes. Paris, 1834, p. 98.

1491. If a vein and an artery connected with it be so injured, that by the subsequent adhesion of the edges of the wounded vessels, an immediate communication between the two vessels is produced, it is called an *Aneurysmal Varix* (*Varix aneurysmaticus*, *Aneurysma per transfusionem. A. arterioso-venosum.*) It occurs most frequently at the elbow-joint, as consequence of blood-letting; it is, however, also observed in other parts (1).

(1) On the upper arm, by **Richerand**, **Cloquet**, **Jaeger**; on the radial artery, and cephalic vein, by **Schottin**; on the subclavian, by **Larrey**; on the carotid, by **Larrey** and **Marc**; on the temporal, by **Bushe** and myself; on the femoral artery, by **Siebold**, **Barnes**, **Dupuytren**, **Breschet**; on the popliteal, by **Lassus**, **Sabatier**, **Richerand**, **Boyer**, **Larrey**, **Hodgson**; on the external iliac, by **Larrey**; and on the division of the *aorta* and *vena cava*, by **Syme**.

[My friend **Mackmurdo** has very recently had a case of aneurysmal *varix* between the internal jugular vein and carotid artery close to the skull. Its existence was not known prior to death. The man had had scrofulous enlargement of the glands of the neck near the angle of the jaw, which suppurated; a sinuous ulcer formed, from which arterial hæmorrhage occurred twice, and **Mackmurdo** thought it advisable to tie the common carotid artery which arrested the bleeding; but the patient sunk after seven days, and on *examination*, besides large destruction of the bifurcation of the carotid artery and of the internal jugular vein, the aneurysmal *varix*, already mentioned, was found.—J. F. S.]

1492. Aneurysmal *varix* is characterised by a circumscribed swelling of blue colour, and small extent, which is formed by expansion of the vein, and in which a peculiar tremulous motion, and whizzing noise are observed, produced by the overflowing of the blood from the artery into the vein. The swelling is generally, at least, at the bend of the arm, not larger than a nutmeg, (on the femoral and subclavian, it has been seen as large as an egg, and even as big as the fist,) accompanied with varicose swelling of the neighbouring veins; it subsides entirely by pressure, shows less pulsation if the part on which it is situated be raised; but is greater if the part hang down, or if pressure be made upon the vein below this swelling. If the artery be compressed above the swelling, the pulsation at once ceases, but returns directly the pressure is withdrawn. The trunk of the artery above the swelling pulsates more strongly than on the opposite side, and is much distended; below the swelling, the pulsation is weaker, but after long continuance the diameter of the artery also is increased, and the artery often becomes tortuous. The size of the swelling depends on the size of the opening of communication between the artery and vein, though the swelling usually diminishes somewhat; if the neighbouring veins be enlarged, it then increases no more, and no longer causes any particular inconvenience. In other cases, however, it is accompanied with diminution of the pulse in the lower part of the artery, with a diminution of temperature, sensation, and motion of the parts below the aneurysmal varix, which fall into a state of complete torpor.

BRESCHET (*a*) has proved, by careful observation and experiment, that in the *systole* the blood flows out of the artery into the vein; and in the *diastole*, out of the vein into the artery; and that, on the latter condition depend, the enlargement of the lower part of the artery, which is often tortuous, and of which, on account of its weaker pulsation, it has been falsely asserted that it is diminished in diameter, as well as the other circumstances and changes of the arterial walls, into a condition similar to that of the veins. By the passage of the arterial blood into the veins, the walls of the latter are thickened, and resemble, in a degree, those of arteries. As in the extremities, the passage of the blood from the vein into the artery takes place more readily than in aneurysmal *varix* on the neck and head; so he explains how the symptoms are milder, and why in the latter, often only during the horizontal position of the head, symptoms as fainting, and the like, occur, they being grounded on the overflow of the blood from the vein into the artery.

[SENNERTUS (*b*) is first considered to have described aneurysmal *varix*; his description, however, is only a little improvement on GALEN's account, already mentioned. (p. 197.) He says:—"The proximate cause of aneurysm is an opening of the internal, with a dilatation of the external coat of an artery. But very commonly it is opened by a wound, when unskilful Surgeons open the artery for the vein, or the artery with the vein. Hence, the external coat being softer and more like a vein more readily unites; whilst the interior being harder, remains open, in consequence of which the blood and vital spirits endeavour to escape through the aperture, and so distending the external tunic, this kind of tumour is produced."

Dr. WILLIAM HUNTER, however, in a paper entitled "*The History of an Aneurysm of the Aorta, with some remarks on Aneurysms in general*," published in 1757 (*c*), first drew the attention of the profession to *aneurysmal varix*. He asks:—"Does it ever happen in Surgery, when an artery is opened through a vein, that a communication of anastomosis is afterwards kept up between these two vessels. It is easy to conceive this case; and it is not long since I was consulted about one, which had all the symptoms that might be expected, supposing such a thing to have actually happened, and such symptoms as otherwise must be allowed to be very unaccountable. In his second paper (*d*) WILLIAM HUNTER says:—"We must suppose that the wound of the skin, and of the adjacent or upper side of the vein, heal up as usual; but that the wound of the artery, and of the adjacent or under side of the vein remain open, (as the wound of the artery does in a spurious aneurysm,) and by that means the blood is thrown from the trunk of the artery directly into the trunk of the vein. Extraordinary as this supposition may appear, in reality it differs from the common spurious aneurysm in one circumstance only, viz., the wound remaining open in the side of the vein, as well as in the side of the artery. But, this one circumstance will occasion a great deal of difference in the symptoms, in the tendency of the complaint, and in the proper mode of treating it: upon which account the knowledge of such a case will be of importance in Surgery.

"It will differ in its symptoms from the common spurious aneurysm principally thus. The vein will be dilated or become varicose, and will have a pulsatile jarring motion, on account of the stream from the artery (1). It will make a hissing noise, which will be found to correspond with the pulse for the same reason." (pp. 391, 392.) In the young lady's case, "there was a hissing sound, and a tremulous jarring motion in the veins, which was very remarkable at the part that had been punctured, and became insensible at some distance, both upwards and downwards." (p. 397.) In the porter, it is stated:—"There is a remarkable tremulous motion, (as well as a considerable pulsation,) both in the bag and in the dilated vein, as if the blood was squirted into it through a small hole. It is like what is produced in the mouth by continuing the sound of the letter R in a whisper. (p. 403.) This motion is not only felt, and seen distinctly, but heard, too, if the ear be held near the part; and if the ear touches the skin, the sound is much more loud and distinct. It is a hissing noise, as if there was a blast of air through a small hole, and interrupted, answering precisely and constantly to the stroke of the heart, or *diastole* of the artery. * * * The patient is so sensible of the noise, that he often finds it keeps him from falling asleep, when the arm happens to be near his head." (p. 404.)

"The blood of the tumour will be altogether or almost entirely fluid, because kept in constant motion. The artery, I apprehend, will become larger in the arm and smaller

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(*a*) Above cited.

(*b*) Opera, vol. iii. book v. chap. xliii. p. 797. Paris, 1641, fol.

(*c*) Med. Obs. and Inquiries, vol. i.

(*d*) Ibid. vol. iv.

at the wrist than it was in the natural state, which will be found out by comparing the size and the pulse of the artery in both arms at these different places," (p. 392); the reasons for which he thus gives:—" Why is the pulse and the wrist so much weaker in the diseased arm than in the other? Surely, the reason is obvious and clear. If the blood can easily escape from the trunk of the artery directly into the trunk of the vein, it is natural to think that it will be driven along the extreme branches with less force, and in less quantity. Whence is it that the artery is enlarged all the way down the arm? I am of opinion, that it is somehow the consequence of the blood passing so readily from the artery into the vein, and that it will always so happen in such cases. That it is not owing to any particular weakness in the coats of the artery, like that in a *true* aneurysm, naturally and constantly tending to rupture, but it has rather such an extension as happens to all arteries in growing bodies, and to the arteries of particular parts, when the parts themselves increase in their bulk, and, at the same time, retain a vascular structure. * * * I presume that the derivation of blood to the arm by the wound of the artery has been the cause of the dilatation of that vessel; and that in the living body an artery will as certainly become *larger*, when the resistance to the blood is taken off, as it will become smaller when it is compressed, or, as it will shrink and become a solid cord when the blood is not allowed to pass through it at all. * * * In order to conceive how or why the trunk of the artery will become larger, in consequence of an immediate and free communication with the trunk of the vein, let us take another view of it, thus:—Suppose that instead of a simple aperture, there was a large branch added to the artery of the same diameter as the aperture, and that it ramified in the common way through some adventitious vascular part, a wen, for example, and terminated in corresponding veins, and that these ended in the common trunk of the basilic vein, every body must see, that in this case the trunk of the artery would dilate till it became proportionable in capacity to its branches; for till then the trunk would be the narrowest part of the canal,—the part where there would be the most resistance, and therefore the yielding coats of the artery would give way till the just proportion was established between the trunk and all its branches. These two cases, I apprehend, are similar as to the principal point, but differ in some particulars. In the case of an aperture, the resistance to the blood is diminished; thence it will move with more celerity; the trunk of the artery will be less enlarged, and the branches will shrink a little. But in the case of an additional branch, the resistance, I presume, would be as great as before; the celerity, therefore, would not be increased, the old branches would continue of the same dimensions, and the trunk would therefore increase still more." (p. 407–411.)

(1) Lawrence (*a*) observes on this point:—" The sensation is almost the same as that which is communicated to the hand by the vibration of the cord of a musical instrument, and it is particularly described by some writers, who call it a rilling noise; some call it a whizzing, and some a vibratory noise. This noise is not only heard in the swollen part of the vein, but it also extends along the course of the vessel up the arm." (p. 166) Liston (*b*) says:—" On applying the ear close to the tumour, or listening through the stethoscope, the peculiar noise is not only felt, but heard of almost startling intensity, somewhat resembling the noise of complicated and powerful machinery softened and confused by distance." (p. 676.)

Liston relates an excellent instance of aneurysmal *varix* in the femoral vein and artery, consequent on a deep chisel-wound in the lower part of the thigh, which at the time bled profusely, but having been stuffed and compressed, healed in course of eight days." A twelvemonth afterwards, troublesome pulsation was perceived in the part; at the same time, the veins of the leg became varicose, and a succession of ulcers formed on the lower and anterior portion of the limb. The affection attracted little attention till between twelve and thirteen years after, when he observed a considerable swelling in the site of the wound, beating strongly, and the pulsations accompanied with a peculiar thrilling sound and feel—not confined to the tumour, though strongest there, but extending to the groin along the course of the femoral vein, which was evidently much dilated throughout its whole course. Six months after, the tumour was nearly equal to the fist in size, of regular surface and globular form, pulsating very strongly, and imparting to the hams the peculiar sensation of aneurismal *varix*, remarkably distinct and powerful. The pulsation and thrilling are continued in a less degree to Poupart's ligament, and down to the calf of the leg. * * * He feels little pain, but exercise and exertion of every kind are seriously impeded." (p. 676.) Firm and constant pressure of the swelling, with uniform compression of the whole limb, were employed, and Liston

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(*a*) Lectures, above cited. (*b*) Elements of Surgery, part ii. London, 1840.

informs me with success. There is at the present time, (April, 1846,) in St. George's Hospital, a case of varicose aneurysm in the thigh resulting from a knife-stab.—J. F. S.

William Hunter also points out the marked distinction between aneurysmal *varix* and false aneurysm. "The natural tendency of such a complaint," says he, "will be very different from that of the spurious aneurysm. The one is growing worse every hour, because of the resistance to the arterial blood; and if not remedied by Surgery, must at last burst. The other in a short time comes to a nearly permanent state; and if not disturbed, produces no mischief, because there is no considerable resistance to the blood that is forced out of the artery." (p. 393.) In the first case which he saw, at the end of 14 years, the swelling, nothing having been done to it, was nearly in the same state. The second case, in which the swelling had the size of a large nutmeg, so remained, when seen five years afterwards.]

1493. The *cure* of the aneurysmal *varix* may be in many cases effected by continued compression, which either effects obliteration of the artery, or brings the wall of the vein so into contact that the aperture of the artery is closed. But as this mode of treatment, if the walls of both vessels be not connected, exposes the patient to the danger of a complication with aneurysm, so may it be employed only in recent cases, and in young or thin persons, where the walls of the vessel can be sufficiently compressed, and the patient recommended abstinence from all exertion of the part, when from that evil no further symptoms are caused (*a*). But if the above-mentioned inconveniences of diminished nutrition, sensation, motion, and so on, occur, the operation is indicated, and not indeed, as by many advised, by tying the affected artery above the aneurysmal part, but according to the old method, by cutting into the sac, and applying a ligature round the artery above and below the wounded part (1).

(1) Breschet has, from the above-mentioned causes, proved that the tying of the artery, according to Hunter's plan, in aneurysmal *varix*, which has existed for some time, produces only temporary improvement, but that all the symptoms soon recur, as before the operation, and render tying the artery below the wounded place necessary; as the opening of communication between the artery and vein does not close, and is kept up by the introduced collateral circulation of the previous condition. He also doubts the benefit of simply tying the artery below the wounded part, as recommended by Brasdor.

In an aneurysmal *varix* of the temporal artery, in which, by tying the common carotid artery, I obtained only temporary improvement, Stromeyer produced a radical cure by tying the vein (*b*). He divided the *varix;* at the bottom of the sac found with trouble *a small opening*, into which he introduced a probe. He freely separated the lower part of the much-*expanded vein*, and applied two ligatures around it; a third ligature tied a vein from the *occiput*, which communicated with the sac. After the *bleeding was thus stanched*, the wound was closed with six interrupted stitches.

[The advice which Dr. Hunter gave to the young lady was "to do nothing while there should be no considerable alteration" (p. 398) in the swelling, which she followed with advantage for fourteen years. And in the second case not a hint is given about tying the artery.

Astley Cooper says:—"No operation bas been required for this disease, in any case which I have seen of it, as it is not a dangerous state, either to the life, or even to the arm. It renders the arm weaker, and nothing more serious arises from it." (p. 84.)

Atkinson, of York (*c*), however, in a large and increasing size of an aneurysmal *varix*, thought it necessary to take up the brachial artery, but the patient died of mortification.]

1494. If a vein, wounded in the way described, be not in immediate contact with the artery wounded at the same time; or if on account of the oblique position of the wound, or by the compression employed, the blood find no obstruction in flowing into the vein, the cellular tissue which connects the artery and vein expands into an aneurysmal sac by which

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(*a*) Scarpa, above cited, p. 432.—Breschet, above cited.

(*b*) Burckhardt, Archiv. der physiologischen Heilkunde von Roser und Wunderlich, 1843.

(*c*) Cooper's Lectures, vol. ii. p. 84.

the two vessels communicate with each other. The vein is somewhat distant from the artery, and the blood flows from the sac into the vein and thus is formed a *Varicose Aneurysm* (*Aneurysma varicosum.*) In this case the aneurysmal sac enlarges, and, it is to be feared, will burst. Clot forms in the sac, and, together with the tremulous swelling of the vein, is felt a firm pulsating swelling, of defined extent, which, if the artery be compressed above, does not, as in *varix*, subside. The above-described symptoms are also present. Tying the artery above the sac, held by SCARPA (*a*) and HODGSON (*b*) most favourable for the cure, is for the above-mentioned reasons most uncertain on account of the speedy danger of a relapse; and tying above and below the sac is the most proper (*c*).

[WILLIAM HUNTER was also well aware of this form of the disease. He says:—"Another difference in such cases will arise from the different manner in which the orifice of the artery may be united or continued with the orifice of the vein. In one case, the trunk of the vein may keep close to the trunk of the artery, and the very thin *stratum* of cellular membrane between them may, by means of a little inflammation and coagulation of the blood among the filaments, as it were, solder the two orifices of these vessels together, so that there shall be nothing like a canal going from one to the other; and then the whole tumefaction will be more regular, and more evidently a dilatation of the veins only. (Such is the *aneurysmal varix.* J. F. S.) In other instances the blood that rushes from the wounded artery, meeting with some difficulty of admission and passage through the vein, may dilate the cellular membrane between the artery and vein, into a bag, as in a common spurious aneurysm, and so make a sort of canal between these two vessels. The trunk of the vein will then be removed to some distance from the trunk of the artery, and the bag will be situated chiefly upon the under side of the vein. The bag may take on an irregular form, from the cellular membrane being more loose, and yielding at one part than at another, and from being unequally bound down by the *fascia* of the *biceps* muscle. (Such is a *varicose aneurysm.* J. F. S.) And if the bag be very large, especially if it be of an irregular figure, no doubt coagulations of blood may be formed, as in the common spurious aneurysm." (pp. 394, 95.)]

In operating on such a varicose aneurysm, when, after the application of a tourniquet, the swelling is cut into throughout its whole length, and the blood absorbed with a sponge, at the bottom of the cavity is seen the aperture made by the lancet, in the hinder wall of the expanded vein. If a probe be introduced into it, it passes into a second sac, but not into the artery, which is ascertained by the ease with which the probe moves around and the difficulty with which it can be carried in the direction of the artery. After the introduction of the probe, this opening is to be enlarged, and the second sac, which is full of coagulated blood and layers of membrane, laid open throughout its whole extent. After emptying and cleaning the sac, the wound of the artery appears in the bottom, through which the sound is to be introduced, and the ligature applied above and below.

[My friend GREEN had some years ago a case of varicose aneurysm, as he considered it, in the frontal branch of the temporal artery and vein, about the size of a walnut, and which resulted from these vessels having been wounded in cupping. The artery entered one end of the sac, but it did not pass out at the other, so that the vein alone had two orifices in it. He removed the whole mass and the preparation is in King's College Museum.

The highly interesting case described by PERRY (*d*) under the name of varicose aneurysm, does not appear to me to correspond at all with the conditions which the term varicose aneurysm generally implies, and in which it is used by both HODGSON

(*a*) Above cited, p. 433.

(*b*) Above cited, p. 507.

(*c*) PARK, in Medical Facts and Observations, vol. iv. p. 111.—PHYSICK, in Medical Museum, vol. i. p. 65.—RICHERAND, above cited.—BRESCHET, above cited.

(*d*) Med.-Chir. Trans., vol. xx. 1837.

and Chelius. The former specially observes:—"If the vein be not in immediate contact with the artery, or if the blood meet with obstruction in its passage from one to the other, in consequence of the obliquity of the wound, the employment of compression, or any other cause, the cellular membrane connecting the vein and artery may be dilated into an aneurysmal sac, through which the two vessels will communicate with each other. In this case the vein will be removed to some distance from the artery, and the *aneurismal sac will be situated between the two vessels;* the blood will first pass from the artery into the aneurismal sac, and from the aneurismal sac into the *dilated vein.* This variety of disease may with propriety be denominated *varicose aneurism*, to distinguish it from *aneurismal varix.*" (p. 507.) In Perry's case, however, there was nothing of this kind. He says:—"At the spot in the thigh where the communication had been presumed to exist between the artery and vein there was an aneurismal sac about as large as a walnut, firmly ossified within, which, by the pressure it had exerted upon the vein, had caused absorption of its coats, so as to form a circular opening of about two lines in diameter, into which the aneurism had burst; thus inducing a free and persistent communication between the vessels. Just below the aperture, the vein was obliterated at a single point, below which it was again pervious. In all the rest of its course up the thigh it was *diminished in size* and *thickened.*" (p. 42.) From this it will be clearly seen, there was neither condition of a varicose aneurysm, neither an intermediate sac, nor a dilated vein, but exactly the contrary. Neither was it an aneurysmal *varix*, for there was no special tumour of the vein, nor was it enlarged, but just the contrary, "diminished in size and contracted." If the account of the case be carefully examined, I think it must be admitted that it is none other than a simple case of aneurysm, having the very rare termination of bursting into a vein, just as in the cases already mentioned (*par.* 1402, *note*) where aneurysms of the *aorta* have burst into the pulmonary artery, which in reality belongs to the venous system, as it conveys the spoiled blood to the lungs for purification. That so far as the femoral artery was concerned, it was subject to aneurysm by dilatation cannot be disputed, for Perry says "the coats of the femoral artery, throughout its whole course, were scarcely, if at all thicker than those of a vein, the attenuation having, as careful dissection afterwards proved, taken place equally in all its coats. Immediately below the origin of the *profunda* the vessel was greatly dilated, having the appearance of an aneurysmal sac. Its coats were here softened and much attenuated, large enough to admit the point of the ring-finger." (pp. 41, 42.) The ossification of the aneurysmal sac at which the artery communicated with the vein has nought to do with the question.—J. F. S.]

B.—UNNATURAL EXPANSION IN THE BRANCHES AND RAMIFICATIONS OF ARTERIES.

von Walther, Journal für Chirurgie und Augenheilkund, vol. v. p. 244.
Breschet, above cited.

1495. An unnatural expansion of an artery, to a greater or less extent, often throughout its whole length, and in its most principal ramifications, with simultaneous lengthening of the vessel, which becomes tortuous, and, with numerous curvings and windings, forms swellings of various size, on many parts presents knotty elevations, or little circumscribed aneurysmal swellings, which sometimes are true sac-like aneurysms, sometimes also mixed aneurysms, with torn internal coat, (Breschet,) produces *Branching Aneurysm* (*Aneurysma racemosum*, *A. cirsoideum*, *A. anastomoticum seu anastomosium*, *Varix arterialis*, *Tumor sanguineus arteriosus.*) It occurs most commonly in arteries of the third or fourth order; on the branches of the carotid, labial, temporal, occipital, ophthalmic, and superior thyroideal arteries; on the arteries of the fore-arm and leg; in the arterial arches on the palm and sole; and in the vessels of the *periosteum.*

1496. This aneurysm is characterized by a more or less strong pulsation of the several expanded arteries, and their various arches and branchings and by knotty, soft, livid, pulsating swellings, forming distinct tumours of various size, which lie contiguously in rows, or even upon each other.

Every increased congestion of blood by exertion, overheating, and so on, increases the pulsation, which, by compression of the principal trunk, is diminished or entirely stopped, and at the same time the swelling subsides and becomes relaxed. From the various situations of this aneurysm, to wit, on the head, peculiar symptoms may arise; the patient hears violent pulsation, has whizzing and roaring in the head, which disturb him in his sleep; often shooting pain in the course of the arteries; and if the swelling lie on a bone, it is absorbed by the pressure, or groove-like depressions are formed on it in the course of the several enlarged vessels. With the quicker or slower enlargement of the swelling, the skin thins more and more, and bleedings at last take place spontaneously, or from trifling causes, which are often difficult to stanch, are frequently repeated, and cause death.

1497. The branching aneurysm is distinguished from other swellings by the distinct pulsation and the considerable expansion of the arteries to a great extent of their course, and by the pulsation of the compressible swelling. The diseased expansion of the capillary vessels or *Teleangiectasy*, never presents any such pulsation and expansion of single vessels; but both may occur at once, the branching aneurysm may subside into a teleangiectasy, or may be developed from it. Examination of branching aneurysm shows the walls of the expanded arteries thin, soft, and falling together, when cut through, like veins, and especially resembling expanded veins. At the situation of the most knotty eminences there are either sac-like expansions of all the thinned arterial coats, or the middle coat is torn and the internal coat protruded with it through this opening under the cellular coat (*a*).

1498. The *causes* of branching aneurysm are either accidental, as wounds of the arteries, contusions, continued irritation, and thereby continued congestion, especially in suppressed ordinary discharges of blood or rheumatic affections. Most commonly there appears to be a general co-operating *diathesis;* for rarely is the affection confined to one part; mostly a more or less general affection of the arterial system shows itself, especially softening of the arterial walls, which increases in proportion to their expansion. Females of middle age and of delicate bodily frame are most frequently subject to it.

1499. The *prognosis* in branching aneurysm, when it has attained a high degree of developement, or when a general *diathesis* exists, is extremely unfavourable. The *treatment* must be directed especially to the origin and seat of the evil. With a defined extent, and when the seat of branching aneurysm is defined, a proportionate and sufficiently great compression, with rest, and the local and internal use of astringent remedies, may be sufficient (Breschet.) If the swelling be superficial, for instance, on the face, and the vessels going to it be not expanded to a great extent, they may be extirpated; this, however, is rarely the case, and the extirpation, on account of the severe bleeding, easily becomes dangerous; and in such cases, as well as in a rather large extent of swelling, its simple or manifold tying, as proposed in teleangiectasy, is proper. The simple tying of the swelling and pressure (1) is also applicable, only to a certain extent, but is always accompanied with danger of severe bleeding and irritation, which happen also from the employment of caustics and the actual cautery. Where the vessels leading to the swelling are ex-

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(*a*) Breschet, above cited, pl. ii. fig. 3.

panded to a great extent, they, to wit, the temporal, occipital, and other arteries, have been severally tied, but their manifold anastomoses have in such cases nearly always soon produced a relapse, even when continued pressure has been kept up on the swelling. Tying the principal trunk, the branches of which are expanded, is in such cases always the most advisable, although experience also shows that even therewith a relapse frequently ensues; in which case the swelling subsides only for a short time, but soon arises again, and increases, together with the pulsation caused by the introduced collateral circulation. After tying the principal trunk it is therefore always advisable to employ a corresponding antiphlogistic treatment, cold applications and pressure (2). If the disease occur on the limbs, and in such degree that the modes of treatment recommended are inapplicable or ineffectual, amputation of the limb is the only remedy, but it rarely has a satisfactory issue.

(1) Graefe, in the largest pulsating swellings, made a long and deep cut, immediately pressed down firmly a large sponge, and, before the blood could escape, quickly applied a soft agaric between the edges of the wound, covered the whole with a sponge an inch thick, and confined it with strips of sticking plaster laid cross-ways and a circular bandage. The result was favourable.

(2) Travers (*a*), Dalrymple (*b*), and Wardrop (*c*) have, in such aneurysms in the orbit, tied the carotid artery with success, which is accounted for by the smaller and less numerous anastomoses. Rogers (*d*) cured an aneurysm by anastomosis of the external maxillary artery by tying the carotid. On the contrary, Dupuytren (*e*) tied the carotid on account of such swelling situated on the ear and region of the *occiput*, for which compression and tying of the temporal, auricular, and occipital arteries had been performed without success; the swelling diminished, the pulsation ceased, but it returned about the seventeenth day, and continued, only less strong than before, in spite of a compressing apparatus. Mussey (*f*) tied both carotids, on account of such swelling upon the crown of the head, with little benefit, as the pulsation recurred four weeks after the second tying; and in the extirpation which was performed two quarts of blood were lost, and forty vessels tied. With equally various result was the carotid tied. (Dupuytren.) I have seen one case, where the femoral artery was tied without benefit, and amputation of the thigh became necessary.

1500. With branching aneurysm in the soft parts, those swellings which depend on similar diseased changes of the arteries in bones, actually agree, and are therefore distinguished by Breschet as *Aneurysm of the arteries of bones*, and by Scarpa as *Aneurysms by anastomosis of bones*.

Pearson (*g*) communicated the first observations on such swellings, and after him Scarpa (*h*). More recently Lallemand has made known a similar observation; and Breschet (*i*) has added remarks, as well as historical inquiries upon the existence of similar cases in the earlier writers, with several observations by Dupuytren. Scarpa (*j*) also has subjected this disease to a special inquiry.

1501. Frequently, from sudden and undiscernible causes, often a shorter or longer time after the operation of any external violence, more or less severe pain occurs upon some one spot of a bone, most frequently in the neighbourhood of the joint-ends of tubular bones, which, when the patient is quiet, diminishes, or even for a time subsides; but then returns more severely. A swelling appears, the veins of the whole limb swell; the pain spreads over the entire limb, which has a bluish-red colour.

(*a*) Med.-Chir. Trans. vol. ii. p. 1.

(*b*) Ibid., vol. vi. p. 111.

(*c*) Ibid., vol. ix. p. 203; and Lancet, vol. xii. p. 267.

(*d*) American Journal of Medical Science, vol. xiii. p. 271. 1833.

(*e*) Rust's Magazin, vol. viii. p. 116.—Breschet, above cited, p. 76.

(*f*) London Medical Gazette, vol. vi. p. 76.

(*g*) Medical Communications, vol. ii. London, 1790; p. 95.

(*h*) On Aneurysm above cited, p. 478.

(*i*) Observation sur une Tumeur Aneurismale, accompagnée de circonstances insolites, par M. Lallemand, suivie des observations et des reflexions sur des tumeurs sanguines d'un caractère èquivoque, qui paraissent être des Aneurysmes des Artères des Os. Paris, 1827. 4to.

(*j*) Annali Universali di Medicina. May, June, 1830.

Pulsation is soon felt in the swelling, which is at first indistinct, but subsequently becomes stronger, and as strong as in aneurysm. This pulsation is synchronous with that of the artery, without a rush, and, if the disease have previously made much progress, with extension of the swelling in every direction. Pressure on the principal artery of the limb, between the swelling and the heart, completely stops the pulsation, by which the swelling loses its tension and subsides, but returns immediately the compression of the artery is removed. The patient has often continued pain in the affected part, which is swollen or wasted, and the motions of which are entirely, or only at the joint, in the neighbourhood of which is the swelling, prevented. If the swelling be pressed with the fingers, there is often observed at some parts a crackling, as in squeezing parchment together, or in breaking an egg-shell. If the bone be completely destroyed, the part may be moved in every direction (*a*). If the swelling be developed in the neighbourhood of a large artery, it may most commonly be followed over the swelling.

Nicol (*b*) has communicated a case precisely like mine.

1502. On examining these swellings after death or amputation of the affected part, the principal vessels have been found throughout their whole course unhurt, and neither by injection nor by the closest examination could any trace of disturbance of their continuity be observed. On opening the swelling, the condition of the parts varied according to the different degree of development of the disease. When the bone was entirely destroyed, the aneurysmal sac, of which the walls were very thick, often cartilaginous, and formed of *periosteum*, contained a quantity of fibrous layers, like those commonly found in aneurysmal sacs, and in it the remains of the destroyed bone. The internal surface of this sac was flocky, irregular, very much like that part of the *placenta* connected with the womb, and presents numerous openings of freely branching vessels, from which, if the part be injected, a portion of the injection flows into the sac. In a slighter degree of the disease the external table of the bone was still found, but very thin, destroyed in some places, in others but slightly resisting the pressure of the finger, resembling a cartilaginous plate, which yields to pressure and again rises, or breaks like an egg-shell. The neighbouring joint was always healthy, even when separated from the aneurysmal sac only by the layers of the loosened joint cartilages. The fibrous clot was collected in the cavity of the bone, or the sac presented several cavities filled with it, wherewith every single artery of the sac corresponds. Upon the external surface of the sac the arteries were very numerously expanded and enlarged, and often were so to a tolerable distance around the sac.

1503. These swellings are developed on the various bones of the body, not unfrequently on several bones of one and the same person; on the skull, trunk, and limbs, most frequently on the upper part of the leg, below the knee, on the shin, or splint bone alone, or on both bones at once (Pearson, Lallemand, Dupuytren); but hardly ever in the middle of the long tubular bones.

The *occasional causes* of these swellings are commonly external violence, a kick, blow, fall, or any violent exertion in lifting a heavy weight,

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(*a*) Chelius, Zur Lehre von den schwammigen Auswüchsen der harten Hirnhaut und des Schadels. Heidelberg, 1831. fol. Erste Beobachtung, p. 43.

(*b*) Edinburgh Medical and Surgical Journal, 1834. July.

and so on, in which the patient feels a crack at the spot where subsequently the disease is developed; the interval, however, between the operation of such cause and the origin of the disease is very great, and during this time the patient often feels no pain, or only indistinct and transient pain. **Lallemand** observed this disease occur after acute rheumatic swelling of the knees. Ordinarily the swelling has a general internal cause, manifestly corresponding with which is its not unfrequent origin without any distinguishable cause, the simultaneous or subsequent origin of several happening in one and the same subject, and especially the circumstance that the disease even reappears in some parts after amputation of the affected limb. On these grounds such swellings cannot be placed, as they have been by **Breschet** and others, in the same rank with teleangiectasy of the soft parts, which is always a local disease, and so remains, even when of considerable extent, whilst this, on the contrary, is usually connected with a constitutional disease.

1504. These diseased changes in the bones appear always to be preceded by an inflammatory condition, in consequence of which the nourishment of the bone is altered; loosening, softening, and absorption of the hard bony mass, a more rich development and enlargement of the vessels, congestion of blood, and complete destruction of the bone are produced. That these diseased changes proceed from the interior to the exterior of the bone, is admitted by all observers, and the cases in which the external plate of bone has been found similar to a thin fragile shell, prove it. But whether this disease be not also developed from the external surface of the bone and from the *periosteum*, and whether the condition of other organic diseases of bone be not changed by an angiectasic complication, as in these swellings, must be decided by further examination and observation.

[It must not be supposed that all pulsating tumours in bone are to be referred to the peculiar form of disease now under consideration, for **Stanley** (*a*) has shown that "three distinct sources of pulsation in such tumours can be recognised. *First.* The proximity of a large arterial trunk. *Second.* The development of blood vessels and blood cells, constituting a sort of erectile tissue within the tumour. *Third.* Enlargement of the arteries of the bone in which the tumour has originated." (p. 303.) Of the first kind he mentions several examples, in two of which "the tumour occupied the whole circumference of the upper arm in its upper third, and possessed throughout an equal and strong pulsation, which ceased on compressing the subclavian artery above the clavicle. In each case the disease was considered to be an aneurism of the axillary artery." One of these cases was, on *examination*, found to be "an encephaloid tumour originating in the *humerus*, and covered by the articular cartilage of the head of the bone. * * * There were no large vessels distributed through it. In the other case, the tumour originated in the *humerus*, and was composed of a firm gelatinous substance, about half an inch thick, and forming the walls of a large cavity, filled by a serous fluid. * * * In this instance no remarkable disposition of vessels through the tumour was observed. * * * In both these cases the brachial artery was perfectly healthy and with its accompanying veins and nerves was found closely united by cellular tissue to the tumour through its whole extent." In a third case, which was under **Lawrence**'s care, and following a fall, "shortly afterwards a painful swelling arose immediately above the knee, and gradually extended around the back part and sides of the lower third of the thigh. Near the tendon of the *biceps*, a softening of the swelling indicated the probability of its containing matter, and accordingly a small puncture was here made into it from which about four ounces of arterial blood freely flowed. On examining the swelling more closely, pulsation in it was now discovered." On consultation it was presumed to be an aneurysm, the femoral artery was therefore tied, the pulsation ceased, and the size of the swelling at first diminished but afterwards it again "enlarged, became painful, and the skin covering it sloughed, the sloughing extended deeply into the tumour, but was

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(*a*) On the Pulsating Tumours of Bone, with the account of a case, &c; in Med.-Chir. Trans., vol. xxviii. 1845.

unaccompanied by hæmorrhage. * * * He shortly afterwards sunk from exhaustion." On *examination*, "the tumour was found to consist of a compound of soft fibrous and dense osseous tissue, the latter situated deeply, and extending around the *femur*, in which it appeared to have originated. The whole series of femoral, inguinal, and lumbar absorbent glands were converted into osseous tumours. The femoral and popliteal arteries were sound. In the lower part of the thigh, the femoral artery was a little compressed and displaced by the ossified absorbing glands which were closely united to it." (p. 304–306.) Under this head STANLEY mentions two cases of HODGSON'S, of encephaloid tumours in the *tibia* just above the inner ankle, of which HODGSON observes :—"To what these tumours owed their pulsation I know not, but I thought it was derived from contiguous arteries." Also a case of LAWRENCE'S (*a*) of "medullary tumour developed in the head of the *tibia*, attended at one period with pulsation and suppression of the pulse in the anterior and posterior tibial arteries at the ankle. In the account of the examination of the limb, Mr. LAWRENCE states that the medullary tumour had protruded from the bone just at the division of the popliteal artery, and the passage of the anterior tibial through the interosseous ligament," which "circumstance accounts for the pulsation felt in the tumour at an early period; for the suppression of the pulse in the tibial arteries when the morbid growth was confined by the *fascia* of the leg, and its subsequent return when the progress of the swelling through the *fascia* had liberated the arteries from pressure." STANLEY also refers to a case of GUTHRIE'S (*b*), in which there was a tumour on the *nates* as large as an adult's head, which was considered to be an aneurysm ; "the pulsation was decidedly manifest in every part; and, on putting the ear to it, the whizzing sound attendant on the flowing of blood into an aneurism could be very distinctly heard. * * * The ligature of the common iliac was followed by a diminution of the tumour to the extent of one half, and the recovery from the operation was complete. Five months afterwards the tumour again enlarged, and she gradually sunk. On *examination* the tumour was found to be composed of cerebriform substance. The arteries were healthy." Of the *second* kind, was STANLEY'S own case :—"The pulsating tumour originated in the *ilium*, it was soft, spongy, and dark-coloured, with cells dispersed through it, each about the size of a pea, and filled with blood. Bunches of convoluted vessels were drawn out of this spongy substance, and, when macerated, this substance was reduced to a tissue closely resembling that of a swelled spleen or *placenta*. Here was a structure capable of enlargement by the distension of its vessels and cells; and, assuming these to have been directly continuous with the arterial system, it may be added, that the rush of blood into such a structure would give to the whole mass a pulsation resembling that of aneurism ; at all events, it is certain that this tumour did possess such pulsation, which ceased directly the *aorta* was compressed through the abdominal parietes; moreover, that the tumour enlarged and became tense when the femoral artery below it was compressed, as an aneurism, under similar circumstances, would have done." Similar to this, is the case given to STANLEY by the younger LAWRENCE, of Brighton, in which the tumour in the right groin having "gradually increased to the size of an egg, was then observed to pulsate, after which it rapidly increased. The pulsation continued, was uniform over the whole tumour, and accompanied by a distinct bruit." The man died, and, on *examination*, the tumour was found to consist "of vessels intermixed with soft gelatinous substance. The vessels formed more than half the tumour, were about the size of sewing thread, and very convoluted; and were directly continuous with the arterial system." (pp. 309, 310.) The *third* form is the disease which BRESCHET and SCARPA here refer to, and with the cases which they have given must be included LUKE'S case, which STANLEY relates, in which a man of 20 years broke his thigh ; "at the end of seven weeks it was firmly united. A month afterwards, by a second accident, the bone was again broken at the same place. Reunion of the fracture ensued, but very slowly and unevenly. A tumour now formed in the situation of the injury ; it was hard in some parts, soft and elastic in others. A grooved needle was introduced into it, and a jet of blood followed. The tumour increased to the size of a large melon, became very painful, and pulsation in it was now discovered. Suspicion of its being an aneurism in consequence arose, and in consultation it was determined to tie the femoral artery ; this was done with the effect of stopping the pulsation of the tumour, and producing a diminution in it to the extent of an inch in its circumference. About a month afterwards the tumour again enlarged, but without the return of pulsation, and it was now deemed right to amputate the limb. The surface of the stump bled so profusely, that more than 40 ligatures were required.

(*a*) Observations on Tumours ; in Med.-Chir. Trans., vol. xvii. p. 39. 1832.

(*b*) London Medical and Surgical Journal, vol. v. p. 831, 1834 ; and vol. vi. p. 101, 1835.

The medullary artery was greatly enlarged, and threw out a forcible jet of blood. The man left the hospital with the stump healed, and in every respect well. On *examining* the limb, the lower third of the *femur* was found expanded into a spherical tumour, in the interior of which were cells of varying size, some of the largest about an inch in diameter, and filled with blood. The femoral and popliteal artery were entire and healthy." (pp. 311, 12.) Although STANLEY places this case among the third kind of pulsating tumours, yet it seems, from the history, that it has greater resemblance to the second.

From the recital of these cases, one important point immediately attracts attention, which is, the absence of any peculiar character by which either form of swelling could be distinguished from aneurysm, for which they seem to have been almost universally mistaken.—J. F. S.]

1505. In *treating* this disease, in some cases applications of various kinds, leeches, rubbing in, mercurial treatment in presumed syphilitic diseases, and so on, have been employed, but without any result. Only can a strict and sufficiently long continued antiphlogistic treatment, with attention to the general causes standing in somewhat causal relation, perhaps prevent the development of this disease. If the swelling have already acquired a certain stage, according to our present experience, *tying* the principal arterial trunk, or *amputation* (if the situation of the disease permit) can alone effect a cure.

1506. Tying the principal trunk of the artery gives the more hope, according as it is undertaken early, even before considerable destruction of the bone has taken place. LALLEMAND's case proves that a permanent cure may be effected ; but when the diseased change in the bone has so far advanced, only temporary diminution of the swelling and removal of the aneurysmal symptoms are effected, whilst the *disease* of the bone continues spreading, as shown by DUPUYTREN's (*a*) case, in which, seven years after the femoral artery had been tied for such swelling at the upper part of the shin-bone, amputation was required, as, without the reappearance of any aneurysmal symptoms, it had attained an enormous size. In all cases where the destruction of the bone has already far advanced, amputation can only be considered as a means of deliverance ; it must not, however, be herein overlooked that with existing constitutional disease, even after the operation, without any cause, the disease may be set up again, as shown in SCARPA's (*b*) first case, in which, five years after amputation, during which time the patient's health was good, the disease, without any cause, again showed itself on the stump of the thigh-bone.

C.—UNNATURAL EXPANSION IN THE CAPILLARY-VASCULAR SYSTEM.

BELL, J., Principles of Surgery, vol. ii. p. 456. On the Aneurysma per anastomosin.

GRAEFE, C. F., De notione et curâ angiectaseos labiorum. Lipsiæ, 1807. 4to.

IBID., Angiektasie ein Beitrag zur rationellen Kur und Erkenntniss der Gefässausdehnungen. Leipz., 1808. 4to; with copper-plates.

RICHERAND, Nosographie Chirurgicale, vol. iv. p. 120.

HODGSON, above cited. p. 441.

ROUX, Relation d'un Voyage fait à Londres en 1814; ou Parallèle de la Chirurgie anglaise avec la Chirurgie française. Paris, 1815, p. 211.

MAUNOIR, J. P., Mémoire sur les Fongus medullaire et hématode. Paris and Geneva, 1820. 8vo.

(*a*) BRESCHET, above cited, p. 15.

(*b*) Above cited, p. 483.

von Walther, Ueber Verhärtung, Scirrhus, harten und weichen Krebs, Medullarsarcom, Blutschwamm, Teleangiektasie, und Aneurysma per Anastomosin; in Journal für Chirurgie und Augenheilkunde, vol. v. p. 189.

1507. By the unnatural expansion of the capillary vessels are produced soft elastic swellings, which, consisting merely of numerous vessels tortuous and connected together with loose cellular tissue, can in respect to their internal structure, be compared with nothing better than the *placenta.* The different designations, *Fungus hæmatodes*, *Tumor fungosus sanguineus*, *Aneurysma per anastomosin*, *Aneurysma spongiosum*, *Blutschwamm*, *Teleangiektasie*, *Tumeur érectile*, *Splenoide* have been applied to them.

I consider *teleangiectasy* the best of all these designations. The term *bloody fungus* (*Fungus hæmatodes*) I employ here, *but not in the sense of* Hey *and others, who thereby designate another degeneration*, for which I consider the term *Fungus medullaris* more appropriate; at least, I cannot, after numerous examinations, admit (as Walther does) any other *Fungus hæmatodes* besides teleangiectasy and medullary fungus.

1508. These swellings, which originally have their seat in the skin and underlying cellular tissue, occur either in children or adults, or are congenital. It generally begins with a red or bluish spot, which at first is little or not at all elevated above the skin, and increases in a shorter or longer time to a variously shaped swelling, in which the patient feels a peculiar crawling and beating, which on closer examination may be more or less distinctly perceived. The colour of the swelling is sometimes more red, sometimes more bluish; it enlarges and pulsates more distinctly at every exertion, by which the circulation of the blood is quickened. When it has attained a great extent, single fluctuating spots arise, the skin thins, bursts, and considerable bleeding ensues, which frequently recurs. The apertures often close with a seemingly firm scar; and often red, fungous granulations spring up from them, which consist merely of clotted blood. The interior of such swelling exhibits a convolution of innumerable vessels enveloped in loose cellular tissue, many cavities filled with blood, and frequently single vessels full of holes, out of which the blood trickles. If these swellings exist in the cellular tissue beneath the skin, the latter retains its natural condition for a longer time; a deceptive sensation of fluctuation is felt; the skin is gradually altered in the way mentioned; the disease rarely extends between the deep-lying organs Swellings of this kind may be very easily mistaken for *fungus medullaris.*

The fungous growths, after the bursting of teleangiectasy, result from clotted blood and considerable development of the *parenchyma* of the swelling; but there never exists in them any specific degeneration (a transition into *fungus hæmatodes,* according to Walther's opinion) if no definite general dyscrasy be present. I have seen many bursten and fungous teleangiectasies, but never any extension to a distant organ, as in medullary *fungus.* Also in this degree, if teleangiectases arise after local diseases, they especially affect the constitution by repeated loss of blood. Upon this, also, depend the favourable results produced by suppuration and scarring, as also the circumstance that bursten teleangiectasies are often closed by a tough scar.

1509. These swellings originate in an unnatural extension, and certainly also in a large development of the capillary vessels; but since these must be considered as the terminations of the arterial, and the commencement of the venous system, we find in such swellings both, but sometimes the arterial, sometimes rather the venous side of the capillary-vascular system affected. This difference manifests itself by the appearance of the swelling, and the circumstances accompanying its development. In teleangiectasy, which affects rather the arterial side of the capillary system, the redness is brighter, the pulsation more distinct, and the enlargement more rapid; but in the venous blood-*fungus* the redness is more dull, bluish, the pulsation less, frequently not at all perceptible, and the growth slower.

JAEGER's assertion, that teleangiectasy never exhibits pulsation, and that this is only the case when it is accompanied with *Aneurysma anastomosium*, is incorrect. Certainly, it never is perceived in flat though extensive teleangiectasy, but it certainly is, when it has risen up to actual *swelling*, and especially in great agitation of the vascular system, when the crawling pulsation is perceptible even to the patient himself.

1510. Besides the considerable ramification and development of the vessels, various changes may also arise in such swellings from thickening and degeneration of the uninjectable part of their cellular tissue, whereby the swelling varies more or less (1) from that above described. Teleangiectasy may also, especially by continued irritation, be accompanied with *aneurysma anastomosium*, if situated where there are numerous arterial ramifications and anastomoses. Teleangiectasy then increases more rapidly stronger pulsation is felt in the neighbouring branching arteries, and the pulsation in the swelling itself even, is greater (*par.* 1496.)

(1) I have seen one such teleangiectasy between the thumb and metacarpal bone of the forefinger, as a dusky red swelling, expanding at certain parts into thin blood sacs, with crawling pulsation, additional swelling, and redness in hanging down of the hand, and diminution of these appearances on raising the fore-arm, or compressing its vessels or the swelling itself with the fingers, in which the sac felt as if full of wool. I applied to it the name of *Teleangiectasis lipomatodes.* Tying the radial artery diminished the extent, and all the other appearances of the swelling (*a*).

1511. The causes of this disease are obscure. It occurs at all ages, and in all constitutions, though most commonly in young subjects of flabby habit, in children, and women. It is developed in all organs, but especially on the upper part of the body, in the skin of the skull, of the cheeks, of the eyelids, and on the lips. A contusion frequently gives rise to it.

I must deny VON WALTHER's assertion that teleangiectasy must be always congenital, because that peculiar vascular development, and alteration of the injectable part of the substance of the organ, which happens in teleangiectasy, cannot arise at a later period of life, if it be not a vice of the first formation during the embryonic state, although unapparent; for I have often seen teleangiectasy commence and be developed in the skin of adults, without any preceding trace; but in such instances the progress will be, for manifest reasons, always exceedingly slow.

1512. Teleangiectasy is throughout a local disease, and the *prognosis* is guided by the nature and condition of the swelling, by its seat, and origin, by the age and constitution of the person affected with it. The congenital red spot often enlarges very quickly after birth, often later; but its enlargement is always to be dreaded at the period of puberty, when even the swelling, whose growth is already determined, at that time acquires increased extent. Bleeding has also been observed from such swellings at the time of menstruation. These teleangiectases have, however, a spontaneous retrocession, and are capable of cure, as I have observed, at different periods of time, in congenital teleangiectasy; and even frequently in those cases in which, from the pale red colour, a quicker enlargement is to be feared. When this occurs, the colour becomes paler; instead of the uniform redness, single vessels appear, between which the skin gradually acquires its natural condition, and the single vessels shrink, so that no trace of the disease remains.

1513. The *cure* of teleangiectasy may be effected by *compression*, by

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(*a*) Heidelberg Med. Annalen, vol. i. p. 101. pl. iv.

removal either by *extirpation* or *tying*, by *destruction* with *caustic* or with the *actual cautery*, by exciting a *pretty violent inflammation and suppuration*, and by *tying the principal trunk of the artery*, with the branches of which the swelling is connected. The choice and preference of the several modes of treatment depend on the condition and seat of the disease, and we must be especially careful in the selection of these, that the teleangiectasic tissue be capable of sufficient inflammation and suppuration, and that the scar thereby produced can be converted into a tough tissue, with obliteration of the vessels, without it being necessary to destroy or remove it entirely.

1514. *Compression of* teleangiectasy, either alone or in connexion, at the same time with astringent remedies or cold, can only be employed in a slight degree of the complaint, in congenital red spots, if their seat permit it, with some degree of success (*a*). I have, however, from this mode of treatment, frequently as I have tried it, never obtained any satisfactory result.

Abernethy (*b*) recommends pressure, and if this be inapplicable, the application of cold rose water and alum. I have instituted several experiments with kreosote, but have never observed the slightest result (*c*). Compression has been used, according to the different seat of the disease, with flat plates and stirrup-shaped compressors, and even with plaster of Paris.

1515. *Extirpation of teleangiectasy* with the knife, is always accompanied with more or less considerable bleeding; as, if the patient be young, and the seat of the disease such that it is not possible to complete the operation quickly, the danger may be imminent and even fatal. Every thing depends on the cut which is carried round the swelling being made at sufficient distance from it in the healthy parts, as otherwise, on account of the very numerous and largely-distended vessels, severe bleeding ensues; and if a part of the swelling be left, its recurrence is to be feared. If it be requisite to leave part of the swelling, the actual cautery must be applied, or caustics with subsequent pressure, in order to cause destruction, and at the same time to stanch the bleeding. After extirpation, the wound is to be treated according to the general rules. This treatment is often tedious, because frequently no satisfactory suppuration ensues, and the edges of the wound long continue loose. In large and flat teleangiectasies, therefore, extirpation can never be employed, but especially only in those which are elevated and have a narrow base.

I have known two instances in which children died upon the operating table in extirpating a teleangiectasy from the face; and, at least in one of the cases, no one could doubt the capability of the highly-distinguished operator.

1516. *Tying a teleangiectasy* has always this great advantage over extirpation, that nothing is to be feared from bleeding. Its employment is specially applicable to projecting swellings with narrow base; but even in the large and out-spreading teleangiactasies, which are prominent, this mode may, according to White (*d*), Lawrence (*e*), and Brodie (*f*), be employed with the best result, as has also happened to me in several cases. Lawrence penetrates the base of the swelling with a strong, slightly-curved needle, carrying a double thread, which is firmly tied on both sides. As soon as the mass of the swelling blackens, it may be cut off with the knife, and the ligature removed. Brodie thrusts a hare-lip

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(*a*) Roux, above cited, p. 248.

(*b*) Surgical Works, vol. ii. p. 228.

(*c*) Heidelberg Med. Annalen, vol. i. pt. i.

(*d*) Medic.-Chir. Trans. vol. xiii. pt. ii. p. 444.

(*e*) Ibid., p. 420.

(*f*) Ibid., vol. xv. pt. i.

needle through the swelling a quarter of an inch from its edge, and a straight needle with a double thread at a right angle with this needle and beneath it; the double ligature is then separated, and each tied under the first needle.

[I prefer BRODIE's method with the two needles, as thereby the whole base of the swelling is more completely included within the thread. If the swelling be large, it will not be possible, at once, to compress it with the ligature, so as to stop the circulation and cause sloughing. In such case it is better to take hold of the middle of the tumour, and having lifted up and squeezed it, so as to empty out the blood, to pass a needle, armed with double thread, through its base. The threads are then to be carefully separated, and each pair of ends being carried round the half bases of the tumour, are tied firmly on opposite sides, and then attached to GRAEFE's little screw tourniquet, a most excellent instrument for the purpose, with which, as the threads, ulcerating the skin, become loose, they are to be every day or two tightened, till the strangulation and mortification of the swelling is effected. In this way I operated, six years ago, on a child, twelve months old, who had teleangiectasies on the temple and ear. She was born with one, about the size of a sixpence, and bright-coloured, on the temple, just above the auricle, which soon became sore, and occasionally exuding a few drops of blood. In the course of nine months, it acquired the size of half-a-crown. When the child was about six months old, two other little ones, about as large as a pin's head, were noticed on the ear, one on the back of the *helix*, and the other on that of the *concha*. All continued growing, but were flat and distinct from each other for the next three months, when they began to rise above the skin, having previously been flat, and soon ran into one another, forming one mass. The principal and most elevated portion was on the head, immediately above the auricle, extending back on the occipital bone, as large as a crown piece, and gradually rising towards the centre, which was half an inch above the surface of the skin. From the lower part it continued on the auricle, covering the top of the *concha*, spreading over the upper part of the *helix*, and turning round upon the front of the ear, as low as the *tragus*. The pulsation in the temporal portion was very distinct; the vessels could be easily emptied by pressure, but immediatly on its removal the tumour resumed its usual size, and swelled out when the child cried. Its colour was bright scarlet, and it had the feel of a mass of small vessels, or rather that of a sponge. The temporal portion was operated on, as I have advised; but although the ligatures were tightly drawn, strangulation could not be effected; the bright colour remained, and the tumour swelled when the child cried; GRAEFE's screw was attached, and the threads drawn as tight as possible, but without change. On the *third* day, serum freely oozed from the surface; and on the day following the ligatures were hidden, but with scarcely any appearance of having cut into the base, and the bright colour remained. The screws were tightened, but no change followed. On the *seventh* day, the ligatures had begun to cut through, and there was a free discharge from the track, but the granulations of the skin were inosculating with the under surface of the tumour, which seemed hardly at all separated. On the *eleventh* day, the screws were again tightened, but without producing any change in the appearance of the swelling. On the following day the hinder ligature came away, but no part of the tumour separated with it; a piece of lint was gently insinuated beneath it. On the *thirteenth* day, the whole swelling appeared about to fall off; it was a little shrunk, but the bright-red colour still remained. On the *sixteenth* day, it came off, leaving a granulating surface which slowly healed and contracted. The child was at this time taken into the country, with the promise of bringing her back again, to have the remaining part on the auricle, which thrust it away from the head, and turned it down at right angle, operated on; but I regret that she never returned. So far, however, as it went, the operation was completely successful.—J. F. S.]

1517. The *destruction of teleangiectasy by caustic* is, in all cases, to be considered as the most proper, where the swelling is broad and superficial, especially in children, as here extirpation with the knife is accompanied with difficulty, and speedy danger of imminent bleeding; and often, on account of the seat of the disease and the delicacy of the child, can be as little relied on as the ligature. The most proper caustic is caustic potash, applied as a paste in an aperture of sticking plaster, put on around the teleangiectasy, or smeared over the part to be destroyed, for the purpose of making a slough of sufficient thickness and size, and then covered with sticking plaster. When the slough is thrown off by suppuration, it is to be treated simply as a suppurating part; healing follows with a corresponding scarcely perceptible scar. In very much spreading teleangiectasy, if on the first cauterization, the disease be not entirely destroyed, and show itself afresh, I have never noticed its quicker spreading, and it is always cured by repeated cauterization. In adults, I have also employed HELLMUND's remedies for destroying teleangiectasy with the best result; it must, however, be recommended for children always with great caution, as, in its extensive application, the possibility of absorption of the arsenic is not to be denied (*a*). The application of caustic potash is especially efficient in congenital teleangiectasy, which appears as little superficial red spots in the skin, by which they may be certainly removed, as every other treatment is declined by the parents on account of the inconsiderable appearance of the disease. The application of caustic potash is, on every account, to be preferred to the actual cautery.

[I have not had much opportunity of watching the result of this practice, as I always either remove a teleangiectasy with a ligature or the knife; but from the few instances I witnessed, I am not inclined to hold so high an opinion of it as does CHELIUS. In one case, especially, in which a great part of the *scrotum* of a child was affected with this disease, the application of muriatic acid, to produce constriction of the vascular mass, had only the effect of exciting irritation and hastening the growth, so that it soon acquired the bulk of an orange. It was then removed by a double ligature, excepting a very small portion, which occupied six weeks, as the ligature was not kept tight. Caustic potash was then applied over the whole granulating surface, after which the sore was allowed to heal; but the vessels were soon again found to enlarge, as well as the little portion of the swelling which had been left. The muriatic acid was again applied, but as unsuccessfully as before, and was followed by abscess, on the healing of which the swelling soon re-acquired the size of an orange, and occasionally bled. I unfortunately lost sight of the case, so that I know not how it terminated, but it was quite evident the use of acid in this way was fruitless.

I certainly would not on any account apply caustic to produce an eschar in cases of this kind, and of large size; as sloughing in children, when once set up, is not always controlable and often dangerous; and a small tumour can be removed with greater readiness, and with less pain, by ligature or the knife, than by caustic.—J. F. S.]

1518. *For the production of a sufficiently violent inflammation and suppuration, to consolidate the tissue of the teleangiectasy and convert it into a mass of scar*, various remedies have been employed. *First*, the frequently repeated and slight touching the teleangiectasy from its circumference towards its centre with caustic potash; by which, after every falling off of the thin slough, suppuration is kept up for a longer time. *Second*, in children who have not been yet vaccinated, the introduction of the cow-pock into the teleangiectasy; several slight punctures are to be made into it and its neighbourhood with a lancet moistened with lymph, and at regular distances apart. If there be bleeding, some lymph is to be at once introduced into the wound with a lancet, and even some folds of linen, steeped in the lymph, applied to the teleangiectasy. Vesicles form in the ordinary manner, and after the slough falls off, the teleangiectasy has ceased (*b*). Similar to this treatment is the application of the *ung. seu emplastr. tartari stibiati* (HICKMANN); after the production of pustules, poultices are to be applied, and after separation of the slough, the parts are to be touched with lunar caustic, and bound up with sticking

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(*a*) Heidelberg. klinische Annalen, vol. iv. p. 499, vol. iii. p. 331.

(*b*) HODGSON; in Med.-Chir. Review, vol. vii. p. 280.—Lancet, vol. xii. p. 760.—YOUNG: in Glasgow Med. Journal, vol. i. p. 93.—DOWNING; in Lancet, vol. ii. p. 237.

plaster. *Third*, the practice recommended by Marshal Hall (*a*), of piercing with a fine needle through the whole mass of the teleangiectasy, close to the sound part, and its repetition in from eight to ten different directions. The punctured canals heal and the tissue is thereby changed. Where possible, pressure may still be employed, but it has no particular effect. *Fourth*, according to Lallemand (*b*), cutting into or cutting out a piece of the teleangiectasy, and uniting the edges of the wound with the twisted suture, or the introduction of long and thick needles through the swelling, which are not however used for twisting round the thread, but their points only bent up, and the part defended with a proper covering. When the needles have suppurated out, if the swelling still continue, they must be introduced again. We need not be uneasy at the bluish, almost blackish, appearance of the swelling immediately after the introduction of the needles; it is a good sign that the inflammation will attain sufficient height. A frequent repetition of the lunar caustic is necessary; perhaps the application of nitrate of silver is better. *Fifth*, the introduction of a seton by means of a needle, through the teleangiectasy, by which the bleeding from the needle-stab is stanched, and by it remaining in a proper degree of inflammation and suppuration is produced (*c*). If the latter do not occur, some irritating injection should be thrown into the puncture, as Lloyd (*d*) has recommended, without the previous introduction of a seton. The advantage of this, as well also as of Hall's practice is that the skin upon the swelling is preserved and a smaller scar made. Of these different modes of treatment, which are especially employed in flat and spreading teleangiectasy, I must, after considerable experience, give the preference to the cauterization which I have proposed (1).

(1) In a case of teleangiectasy spreading over the whole right side of the face, and nearly over the entire upper lip, and which at several parts, especially on the upper lip, was very puffy and prominent, after all other means had been quite useless, I entirely removed it, and converted it into a smooth mass of scar by very frequently repeated cauterization with nitrate of silver, by which the upper lip was at the same time brought back to its natural thickness.

[Pattison (*e*), of New York, in a case of teleangiectasy as big as a pigeon's egg, on the shoulder of an infant eleven months old, varied Hall's operation, by passing "needles made red hot with a spirit-lamp, in rapid succession, about twenty times, into the tumour in all directions. There was no hæmorrhage, and the child apparently suffered little pain. The operation was repeated twice afterwards, after intervals of a week, and in the course of a month the tumour had entirely sloughed away, and the part healed without a vestige of the diseased structure being left."

Smith (*f*), of Baltimore, recommends the introduction of threads soaked in a solution of lunar caustic, and dried at the fire, by a needle passed through the base of the tumour at different parts.

Tyrrell was in the habit of injecting these teleangiectasies with strong solution of alum, first making a puncture with a lancet, and then inserting an Anel's syringe. The operation generally required repetition two or three times; after each of which the swelling became more and more solid, and subsequently shrunk away. No inflammation of consequence ensued.—J. F. S.]

1519. If the seat and extent of the teleangiectasy admit neither of the prescribed treatments, or if they be employed without benefit, or if ex-

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(*a*) London Med. Gazette, vol. vii. p. 677.—Lancet, 1834. April.

(*b*) Archives générales de Médecine. May, 1815.

(*c*) Fawdington; in North of England Medical and Surgical Journal, vol. i. p. 66.—Macilwain; in Medic.-Chir. Trans. vol. xviii. p. 189.

(*d*) London Medical Gazette, October, 1836.

(*e*) London and Edinburgh Monthly Journal of Med. Science, 1842, p. 552.

(*f*) American Journal of Med. Science, vol. vi. p. 260, 1843.

pansion of the anastomosing branches of the arteries exist at the same time with the teleangiectasy, the final remedy is tying the principal trunk of the arteries with which the swelling is connected, and if this be insufficient in teleangiectasy of the extremities, amputation of the affected part must be performed. It is always advisable to apply a ligature before proceeding to amputation, as the latter can always be done if the former fail and the swelling increase, after the vessel has been tied, by the collateral circulation; it is therefore of the utmost importance to apply the ligature as near as possible to the swelling. In extensive teleangiectasy on the head, experience shows that tying the common trunk of the carotid artery even on both sides, has rarely permanent result.

Besides the early-mentioned cases of tying the carotid artery on one and both sides, (*par.* 1436,) and in branching aneurysm, (*par.* 1200,) compare also the case of a very large teleangiectasy on the ear, in which tying the carotid artery produced only momentary benefit (*a*). MOTT in a child of three years old obtained only imperfect result from tying the carotid artery, and subsequently tied the carotid on the other side. MÖLLER, in a child of four years old, tied both carotids with success (*b*). I knew a case, where in very extensive teleangiectasy of the ear and its neighbourhood, tying both carotids, continued pressure and deep cuts which were successively made in the sound skin in the neighbourhood of the swelling, to produce a satisfactory scar, had no permanent result.

When JAEGER (*c*) asserts that amputation in simple teleangiectasy is never necessary, and that where undertaken it would not succeed on account of *fungus*, I must deny this assertion. Teleangiectasy is of itself able, without branching aneurysm or other degeneration, to attain so frightful an extent, that no other means than amputation remains. I have seen one case in which a teleangiectasy showed itself after birth, as a small red spot in the middle of the upper arm, and in six months the frightful spreading had reached over the whole arm, from the elbow up to the shoulder and shoulder-blade; but the parents of the child would not decide on permitting anything to be done for it. In the case of an extensive teleangiectasy on the knee, which I formerly mentioned, where tying the femoral artery was unsuccessful, amputation was the only means of restoring the patient.

The *Tattooing* of moles on the skin, proposed by PAULI, has yet to be mentioned. The part should be washed with soap and water, and rubbed till the blood is introduced into the most delicate branches of the erectile tissue; the skin is then made tight, and covered with colour similar to the natural colour of the skin, which is formed of white lead and carmine. Three needles, sunk into a cork pad so that their points project, are then thrust into the skin, and their points from time to time dipped in the paint. In extensive spots we must proceed gradually, so as not to produce too great swelling. The most difficult part is the choice of colour corresponding to that of the skin.

(*a*) VON WALTHER, above cited, p. 241.

(*b*) JAEGER, Handwörterbuch, vol. i. p. 497.

(*c*) Above cited, p. 298.

D.—OF UNNATURAL EXPANSION OF THE VEINS.

Of Varices.

I.—OF VARICES IN GENERAL.

Desault, Œuvres Chirurgicales, vol. ii.

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Hodgson, Joseph, On Diseases of Arteries and Veins, above cited.

Brodie, Observations on the Treatment of Varicose Veins of the Leg; in Med.-Chir. Trans., vol. vii. p. 195.

——, Lectures illustrative of various subjects in Pathology and Surgery. 8vo. London, 1846.

Bell, Charles, System of Operative Surgery. London, 1807-9. 8vo. vol. i. p. 89.

1520. The veins are, on account of the weakness of their membranes, subject to a great degree of extensibility, and then form swellings which are called *Vein-knots* (*Varices*, Lat.; *Blutaderknoten*, *Krampfadern*, Germ.; *Varices*, Fr.)

1521. Expansion of the veins generally takes place very slowly, and at first is not accompanied with any inconvenience; it gradually increases, the veins describe, in their course, larger curves, form unequal, defined, bluish or blackish prominences, which diminish on the application of pressure, but quickly return on its withdrawal, and cause a sensation of weight, and often severe pain in the part where it is situated. Varicose veins, by their lying together, often produce large swellings and *œdema* of the whole part: the coats of the veins thicken, adhere to the neighbouring parts; the skin covering them inflames, abscesses form, ulcerations also take place in the skin, and cellular tissue, (varicose ulcers,) which are closely connected with this varicose state, and so long as it continues cannot readily be induced to heal (1). Often by bursting of the vein considerable bleeding ensues; and sometimes the blood is poured into the cellular tissue by tearing of the vein. Often the blood coagulates in the expanded vessel, and the knots thereby produced are hard and incompressible (2). For the most part only the superficial, more rarely the deep-seated veins, in many cases not only the venous trunks, but also the minute branches, sometimes they alone, are expanded, and considerable swellings arise here and there.

[(1) Brodie says:—"For the most part, the effect of inflammation of a varicose cluster is not to produce either abscess or ulcer. It is very remarkable that the blood in inflamed varicose veins coagulates; and they become choked up with the coagulum. There seems to be something in an inflamed vein that is unfavourable to the fluidity of the blood which it contains. You observe this not only when varicose veins of the leg are inflamed, but when the veins are inflamed under other circumstances, as in a case of piles. A patient comes to you with an external pile, which is large and very tender—it is inflamed. At first it contains fluid blood, but in a day or two it becomes filled with solid matter, and if you slit it open you find a solid lump of dark-coloured fibrine. If you slit open an inflamed varicose cluster in the leg, under these circumstances, you will also find that the cavity is filled up in like manner with coagulated blood. * * * The coagulum fills up the vein, and the vein becomes obliterated. Other varicose clusters may appear afterwards, but this one is cured. * * *

By degrees the inflammation subsides; the coagulum becomes gradually absorbed; as the absorption proceeds, the sides of the vein approximate, and it assumes the appearance of a narrow cord. In old cases of varicose veins, you will frequently find the skin become affected with a chronic inflammation; that is, it will look red, and be very irritable and tender. Sometimes the cuticle is, as it were abraded, and an ichorous discharge takes place from the red *cutis*. Occasionally the whole of the skin of the leg is in this condition. In other cases there is a chronic inflammation of the cellular membrane. There is an effusion of serum into it and the limb becomes œdamatous. * * * These inflammations are analogous to what we meet with in other cases of venous congestion. But in some instances you find inflammation taking place of a different kind in the cellular membrane, immediately surrounding the varicose cluster. The cellular membrane becomes infiltrated with coagulated lymph, so that the varicose cluster is, as it were, imbedded in a mass of solid substance. At first you would suppose that these veins are obliterated, but they are not so. The lymph which has been deposited becomes organized, and the coats of the vessel are thickened, but they remain pervious nevertheless, containing fluid blood, which may be perceived with the finger, flowing freely through the gristly mass. Where there is this deposit of lymph in the cellular membrane round the vein, the skin becomes inflamed near it, and this may give rise to a troublesome ulcer. The more usual history of a varicose ulcer, however, is as follows:—the skin is distended at some point, and a scab forms upon it. When the scab comes off there is an ulcer, and the ulcer spreads. The varicose ulcer in most instances begins about the inner ankle, but it may occur in other parts of the leg. * * * Such ulcers are inclined to assume an oval form, the long diameter of the oval extending in the course of the vein upwards and downwards. They are generally nearly on a level with the surrounding skin. The surface of them is dark-coloured, when the patient is erect, and when the small veins are filled with blood; but when the patient lies down it becomes florid; the change taking place very speedily from dark to florid and from florid to dark. The skin and the margin of the ulcer are generally of a dingy-red colour and partly deprived of the cuticle, so that it is often difficult to say where the latter terminates and the ulcer begins. Varicose ulcers are generally very irritable and painful. If the patient be very much upon his feet, they assume a foul and sloughy appearance, and not infrequently are disposed to bleed." (p. 165–168.)

(2) Hodgson (*a*) says correctly:—"The deposition does not in general fill the vessel, but, by diminishing its calibre, it retards the flow of blood, and causes the dilatation to increase in the inferior portion of the vein, and in the branches which opened into it. Petit, who had observed this circumstance (*b*), was accustomed to open varicose veins, and draw out the string of coagulum. By removing this cause of obstruction, not only the increase of the disease was prevented, but the dilated vessels frequently diminished after the operation. Sometimes, however, the coagulum accumulates to such an extent as completely to obliterate the canal of the dilated vessel. "I have seen," says Hodgson, "four cases in which this event terminated in the spontaneous cure of *varices*." (p. 541.)]

1522. The *cause* of varix is every hindrance to the flow of blood in the veins, as pressure and constriction, with continued flow of blood from the arteries, increased venosity, pressure of the gravid womb, costiveness, peculiar direction and position of the body, for instance, the erect posture and so on (1). Sometimes varix occurs without any perceptible hindrance to the circulation in different parts of the body, and seems to depend on weakness of the venous coats. Varices mostly show themselves where under natural circumstances the return of the blood is somewhat difficult therefore especially in the lower limbs (2), in the veins of the *rectum* and spermatic cord. The expansion of the veins is closely connected with the constitutional relations of the patient and certain diseased conditions, so that in a manner it operates favourably, and belongs to the well-being of the patient.

[(1) Dr. Baillie (*c*) mentions a case of obliteration of the *vena cava inferior*, which "was found to be changed into a ligamentous substance, from the entrance of the emulgent veins even to the right auricle of the heart. The cavity here was so entirely oblite-

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(*a*) Above cited. (*b*) Above cited, p. 41, p. 63.

(*c*) Of uncommon appearances of Disease in Blood-vessels; in Trans. Med. and Chir., vol. i. 1793.

rated, as not only to prevent all circulation of blood through this part of the vein, but even in a great measure to prevent the admission of air by inflation. * * * The blood being prevented from passing through the *vena cava inferior*, flowed into the lumbar veins, enlarging them gradually, as that vein became contracted, till they were of sufficient size to receive the whole blood which returns by the *vena cava*. * * * The enlarged veins were in some places thrown into *varices*, as must naturally take place under the circumstances we have mentioned. (pp. 127, 28.)

Brodie (*a*) says he has seen varicose veins of the fore-arm to a considerable extent. There had been inflammation of the median-cephalic and cephalic veins. These had become obliterated, and in consequence of their obliteration, the blood did not easily return from the fore-arm, so that the veins became varicose." (p. 159.)

Scarpa (*b*) observes :—" The celebrated Mr. Cline having found in the body of a man, the *inferior vena cava* obliterated a little above its bifurcation, in consequence of a steatomatous tumour, which had formed in the cellular tissue behind the *peritonæum*, and which occupied a part of the *pelvis* and lumbar region, remarked that the epigastric veins were become as large as the little finger, and that the superficial veins of the *abdomen*, as well as the lumbar, and those of the internal cavity of the *abdomen*, were in a similar manner very much dilated ; the internal mammary vein likewise greatly enlarged, and also the epigastric, with which it anastamosed, opened, as usual, into the *superior cava*, near to the origin of the subclavian veins ; by which circumstance the venous blood of the lower extremities was poured into the *superior cava*, by means of the mammary vein, and into the *inferior cava* by the lumbar veins above the compression caused by the steatomatous tumour." (p. 21, *note*.)

Brodie relates the case of " a man who had varicose veins all down the right arm, and to a considerable extent down the right side of the chest. He had difficulty of breathing, and cough. One day he felt as if he had received a blow on one side of the chest, and immediately a large abscess presented itself externally, as big as an orange, which had evidently made its way from the inside of the chest through one of the intercostal spaces. Immediately upon the appearance of this swelling, the varicose veins disappeared. The man died, and on *examining* the body after death, it was found that there was disease in the bronchial glands ; suppuration had taken place in them, and a large abscess had been confined in the inside of the chest, which pressed on the right subclavian vein, and this caused the blood to stagnate in the veins in which it had its origin, and which had in consequence become varicose." In another case, " the superficial veins of the chest and upper extremities were extensively varicose. * * * On *examining* the body, a large medullary tumour was discovered within the chest, which by its pressure on the lower part of the *trachea*, and on the junction of the two subclavian veins, had obstructed at once the entrance of the air into the lungs, and the return of the blood to the *superior vena cava*." (pp. 159, 160.)

(2) Generally speaking, the superficial veins are most prone to become varicose, and specially those of the lower limbs. Hodgson says :—" The only instance of *varix*, in the upper arm, with which he was acquainted, is mentioned by Petit (*c*) ; it was situated at the bend of the arm, and the patient was so fat that no other vein could be found for the purpose of venesection, which operation Petit repeatedly performed by puncturing this *varix*." (p. 539.)

Brodie's cases just mentioned are also examples, though from different cause.

Velpeau says he has seen in two persons the arms, fore-arms, and hands covered with varicose swellings ; also a mass of *varices* as big as the fist, between the angle of the jaw and the right clavicle, in a young man ; a *varix* as large as the thumb under the edge of the orbit in a girl ; and a pretty large one, in a man, upon the course of the sagittal suture, which seemed to come from the longitudinal sinus. And he mentions another, as big as the thumb, beneath the tongue. (p. 420.)

But the deep veins also occasionally are so affected, as in the instances just cited even within the great cavities of the trunk. I have also very recently seen in St. Thomas's Hospital, a varicose enlargement of the femoral vein, immediately below Poupart's ligament, as big as half a pigeon's egg, and in the seat of femoral rupture, for which it might have been easily mistaken. Hodgson also says :—" Mr. Cline described in his lectures the case of a woman who had a large pulsating tumour in her neck, which burst, and proved fatal by hæmorrhage. A sac proceeded from the internal jugular vein. The carotid artery was lodged in a groove at the posterior part of this sac." (p. 539.) I have no doubt that this is the brief history of a preparation in the Museum at St. Thomas's, which precisely corresponds with the account.—J. F. S.]

(*a*) Above cited.

(*b*) On Aneurism (Translation.)

(c) Traitè des Maladies Chirurg., vol. ii. p. 49.

1523. The *cure* of varix first requires the removal of the cause which hinders the circulation in the veins; and this done, it frequently disappears of itself. Obstructions in the bowels must be got rid of, the mode of living properly regulated, continual standing, and the like, forbidden. The most proper remedy, if after the removal of the causes the knots do not subside, or if they depend on local weakness, is the suitable compression of the whole part with bandages, the effect of which is assisted by the employment at the same time of strengthening contracting remedies. A radical cure thereby is rarely effected, for when the compression is removed, the swellings of the veins, *œdema* and varicose ulcers return.

[Brodie says:—"In many cases where the disease is limited, you may apply merely a partial bandage of adhesive plaster, which will answer the purpose perfectly, giving the patient scarcely any inconvenience. There being, for example, only two or three varicose clusters of small size, you need not trouble the patient with a complete bandage for the whole leg. * * * Having marked the place, (whilst the patient stands erect,) let him recline with the foot raised so that it may be the most elevated part of the whole body. Then, the *varix* having been thus completely emptied, apply one of the pieces of adhesive plaster (three or four inches long, and an inch or an inch and a half wide) across the varicose vessels, and afterwards apply the others in the same manner, drawing up the skin under them, and taking care that the plaster is not thrown into folds. The plasters being applied in this manner, and being strained on the skin beneath, prevent the vein from becoming distended when the patient stands erect." (p. 169.) If the skin be irritated by the resin in the adhesive plaster, he recommends instead *emp. thur. comp.* with a little soap cerate, or soap plaster spread on *amadou*. "In those cases, however, in which the veins of the leg are extensively varicose, this partial compression will not be sufficient, and you must apply a bandage for the whole leg." (p. 170.) Calico, flannel, or stocking-web roller; the Indian rubber web confines too much heat, and does not, in most instances, afford sufficient support to the weak vessels. Laced stockings, either of nankeen, Indian rubber cloth, or spiral wire are sometimes used, but the latter two are objectionable, on account of the heat.

If the varicose veins become inflamed, the patient should be kept in bed in the recumbent posture, have cold lotions applied, and his bowels freely opened; and occasionally it may be necessary to employ leeches, on the use of which Brodie gives the following very pertinent advice:—"Do not apply them immediately over the veins; they should be applied higher up on the leg, on the sound skin. The bite of a leech over an inflamed vein will give the patient a good deal of pain, and the little wound will be difficult to heal. If you apply the leeches on the sound skin on the thigh, or the upper part of the leg, you will relieve the varicose veins just as much as if you had applied them on the veins themselves, without giving the patient pain at the time, or trouble afterwards." (p. 173.)]

1524. In order to effect a *radical cure* of varices by closure with a clot of blood, and by obliteration of the vein, various remedies have from the earliest times been proposed. *First*, puncture; *second*, incision; *third*, extirpation; *fourth*, tying; *fifth*, cutting through; *sixth*, application of caustic; *seventh*, piercing with needles or threads; *eighth*, lateral compression of the veins.

According to Gottschalk (*a*), the destruction of a vein never produces a radical cure; on the contrary, the especial cause of varicosity, to wit a slow circulation in the veins, is further increased; hence there results from tying a venous trunk *œdema* of the limb, and aggravation of the disease, in addition to the danger of tying the vein. Support of all the veins by simultaneous compression is the true mode of cure, and there is nothing more proper for this than a paste roller. A moist roller is first applied, and then smeared with paste, and over it a second paste roller. The moisture cools the limb pleasantly, and the regular pressure removes all the weight depending on expansion of the veins.

1525. *Puncture of the varix* with a lancet (anciently proposed by Hippocrates) must especially be employed in varices largely filled with

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(*a*) Oppenheim's Zeitschrift für die gesammte Medicin, vol. xxii. pt. ii.

coagulated blood, as well also as in those which are very painful, inflamed and much expanded; and, after the removal of the blood, pressure, together with cold applications and the horizontal posture are to be employed.

1526. In cases of larger size and greater extent, the skin and the vein must be *cut into*, by an incision two inches long, upon the largest knot, the escaping blood kept back with the finger, the cavity of the vein plugged with sponge or lint introduced into it, and the bleeding stanched by the application of compresses and circular bandages. If the varicose expansion be only on the leg, one cut is sufficient; if it extend to the middle of the thigh, one cut is to be made above the ankle, a second close above the knee, and if the whole thigh be affected, a third cut is to be made at equal distance. The limb is then to be bandaged, and cold applications to it used for some days. Inflammation takes place in the vein which so spreads from the principal to the other varix, that a greater degree of plasticity arises in them, and the neighbouring varices disappear (*a*).

1527. In some very prominent knots, or even in swellings formed by the agglomeration of various veins, *extirpation*, (*cirsotomia*,) originally proposed by CELSUS, has been practised. In the separate knots, the skin, if movable, should be cut through in a single fold, so that the cut may reach from above to below, over the knot, which is then to be raised with the hook, separated, and cut off above and below. If the skin be adherent, it must be taken away as well as the knot. In the same manner the large swellings are to be treated, and the divided vein tied at its upper and lower end; or, if the position permit it, the bleeding is to be stanched by pressure (*b*).

1528. *Tying* (proposed anciently by AETIUS and PAULUS ÆGINETA) is to be performed in varix of the lower extremity, on the principal trunk of the saphenous vein, above the swollen part, which is to be laid bare by a suitable cut through the skin, freed from cellular tissue, and the ligature carried round it with a probe; after which, pressure is to be kept up in the horizontal posture (*c*). RICORD (*d*) removes the subcutaneous connexion of the vein, lifts up the vein in a fold of the skin, and thrusts a suture needle, armed with a double thread, through the skin behind the vein, then lets go the vein, without leaving hold of the skin, and carries the needle back through the same holes reversed above the vein, so that the vessel is caught in a subcutaneous loop, both ends of which being held together at the same wound in the skin, are tied on a piece of elastic bougie as in the quill suture. In a similar way, but with two loops, the subcutaneous tying may be performed, according to TAVIGNOT's method. (*par.* 1432.)

[The practice of tying the saphenous vein was revived by Sir EVERARD HOME, for varicose veins of the leg, either with or without ulcers; and he stated (*e*), "that in the course of a week after the operation, the veins in general were very much diminished in size; and in all the cases the ulcers put on a much more healthy appearance in less than three days after the operation; and from that time, where no circumstance occurred to prevent it, went on healing like ulcers in healthy parts." (p. 330.) It, however,

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(*a*) GRAEFE, in his Introduction to C. BELL's Surgery.

(*b*) BOYER, Traité des Maladies Chirurgicales, vol. ii.

(*c*) C. BELL, above cited, p. 91.—HODGSON, above cited, p. 550.—MOULINIE, J.

(*d*) Du Traitement des Varices par la Ligature sous-cutanée des Veines; in Bullet. général de Thérapeutique. July, 1839.

(*e*) Practical Observations on Ulcers. Second Edit. 8vo. 1801.

happened after this statement, that several patients died from inflammation of the vein following the ligature; and I recollect being present at an operation of this kind, after which the patient became extremely ill and delirious; and, though she recovered of the operation, lost her senses, and was obliged to be placed in a madhouse. These results put a stop to this dangerous practice, vaunted as it had been by HOME; and there are, I apprehend, few persons who would now venture on performing it.—J. F. S.]

1529. SOLERA practised *cutting through the vein above and below the knot*, above the knee and low on the leg; he made a longitudinal cut by the side of the vein, cut through the vein, and prevented its union by the introduction of lint. BRODIE (*a*) makes the subcutaneous division of the vein, but he thrusts a narrow, very pointed, slightly-curved bistoury, flat on the side of the vein, between it and the skin, and, in withdrawing it, cuts through the vein without wounding the skin. The bleeding is stanched by pressure.

[In reference to the sub-cutaneous division of varicose veins, BRODIE observes:—"Although there may be danger from operations on the *vena saphena*, we have no right to expect danger from operations on its smaller branches" (p. 188); and it was upon these he formerly operated. "With my present experience," he, however, observes, "it really appears to me that, in ordinary cases, it is not worth the patient's while to submit to it, as I always observed that, if I cured one cluster, two smaller ones appeared, one on each side, and that, ultimately, I left the patient no better than I found him. The operation, however, is proper where there is a varicose cluster much distended, and liable to burst and bleed. Here you may actually save the patient's life by having recourse to it; and you may do so without considering whether fresh clusters are or are not likely to form afterwards." (pp. 189, 90.)]

1530. The *application of the actual cautery* (according to CELSUS, upon the knot laid bare by a cut through the skin) and the *destruction of the skin and the knot with caustic potash* (PARÉ, BRODIE) have been given up on account of the obstinate ulcers to which they gave rise (1); but the employment of caustic potash is again recommended by BONNET (*b*) and LAUGIER (*c*). BONNET at the same time employs the introduction of needles after DAVAT's method, and the latter applied the caustic upon the vein, after laying it bare with a cut through the skin. VON FRORIEP overlays very large expanded veins of the lower extremity with compresses, moistened with concentrated, not smoking nitric acid, till the skin becomes erysipelatous, and the swelling firm and painful, and repeats it, after the subsidence of these symptoms, till the cure.

[(1) MAYO (*d*) has also recommended the use of caustic potash, or a caustic paste on the sub-cutaneous venous trunks of the leg in cases of *varix*. "The vein," he says, "is often tender during several days, for the extent of three or four inches above the place at which the caustic is applied. The obstructed part does not exceed more than half an inch to an inch in length. I have never known acute *phlebitis* supervene in employing this practice." (p. 433.) BRODIE, however, is now entirely opposed to it; he says:—"The application of the caustic potash was very painful; the slough took a long time to separate; the sore took a long time to heal, and where one cluster was cured, other clusters appeared. Altogether it was a very tedious process, and my own experience does not lead me to recommend it." (p. 187.)]

1531. The *introduction of needles through the walls of a vein* produces either only slight irritation of the vein, and the formation of a clot, which fills its area, and finally causes its obliteration; or, with a less degree of irritation of the opposite points of the internal coat of the vein, and their simultaneous contact, produces its obliteration. In the *first* proceeding

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(*a*) Above cited.
(*b*) Archives générales de Médecine. June, 1839.
(*c*) Bulletin Chirurgical. August, 1839.
(*d*) Outlines of Human Pathology.

a pin (an insect-pin) is to be carried transversely *through* the vein, and left there for from two to six days with rest, and corresponding dietetic treatment of the patient. On the second day swelling around the pin begins, which is caused partially by the clot formed in the vein, partially by the slight inflammatory process set up in, and around it. The swelling increases on the following days, becomes at the wound, more rarely throughout its whole extent, of a pale rosy-red colour, and at the same time the vessel, as well as its neighbourhood, without pain on pressure, feels more compact. The earlier this appearance sets in, the sooner may the pin be removed. With small veins one pin is sufficient; but in the larger it is better to introduce two or three, in which case the one brings the front, the other the hind wall of the vessel nearer together, and the third is thrust through the middle of the vein. Experience is strongly in favour of the symptoms ensuing, and of the results arising from this mode of treatment (*a*). In the *second* proceeding, a pin is to be thrust transversely *under* the vein, which is to be raised up by it, so that a second pin may be thrust *through it twice*, in the longitudinal direction. With this object a second pin generally straight or curved, round or flattened, is introduced through the skin and vein, about a line below the place where the transverse pin cuts the axis of the vessels, carried upwards beneath that pin, and thrust from within outwards through the vein and skin—the two pins, forming a cross, are to be surrounded with a thread. One pin may be also thrust transversely through the skin and vein, and a thread twisted round it, like a figure of ∞. The pin is to be left till it have excited inflammation (about five days.) The little fistulous wound soon heals. This mode of treatment should be preferred before all the rest, on account of its slightness, of its less pain and danger, and the certainty of the cure (*b*). Experience, however, shows that wide and deep-spreading phlegmonous inflammation, with fever, redness of the tongue, sooty colour of the teeth, irritation of the mucous membrane of the stomach, swelling of the inguinal glands, extensive suppuration, and even death may ensue from this practice (*c*). According to FRANC (*d*), the pin should be thrust through the skin near the vein, carried behind it, thrust out at the other side, and a thread wound around it. Two days are sufficient to produce complete obliteration of the vein (1). FRICKE (*e*) introduces, with a moderately strong needle, one, and, in great varicosity, several threads dipped in oil through the vein, and ties the ends upon the skin in a bow. In from twenty-four to thirty-six hours the threads are to be removed, the patient kept quiet, without any dressing, and, on the appearance of inflammation, cold water or lead wash are to be applied.

[(1) VELPEAU (*f*) says, that he "never saw, in more than one hundred cases in which he had performed his operation, any troublesome symptom; a slightly spreading external *phlebitis*, some little phlegmonous swellings, and small abscesses, were nearly all the consequences. Often pleasing myself," says he, "with my continual success, you may

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(*a*) KUH, C., Die Heilung der Blutader-Erweiterungen durch Acupunctur. Breslau, 1838.

(*b*) DAVAT, Thèse, De l'Oblitération des Veines. Paris, 1833; in Archives générales de Médecine. May, 1833.—Du Traitement curatif des Varices par l'Oblitération des Veines à l'aide d'un Point de Suture temporaire. Paris, 1836.

(*c*) DUFREISE, in Journal Hebdomad. 1836, p. 265.—LANDOUZY, H., Du Varicocèle, et en particulier de la cure radicale de cette affection. Paris 1838. 8vo.

(*d*) Journal des Connaissances Medico-Chirurgicales. 1835. July.—VELPEAU, in Revue Medicale, July, 1838.—MELWIN, in London Med. Gazette, Oct. 1838.—PUPPI; in Annali Univers. di Medic., 1837, Nov., Dec.

(*e*) Medicinische Zeitung. Berlin, Aug. 1833. Hamburg. Zeitsch, vol. i. pt. i. p. 12.

(*f*) Leçons Orales.

judge what fear I had of it coming to an end. Unfortunately, at last it came." A patient was operated on by him on *April* 4, 1839, two of the pins were removed on the *sixth*, and the other two, with the ligatures, on the following day, the tied parts being scarred, and the patient free from pain. On the *eleventh* night, however, he was attacked with intermitting shiverings accompanied with nausea and vomiting; and on the following morning the leg was red and swollen, which extended next day up the thigh, and where the ligatures had been applied the skin assumed a violet-colour, and livid spots appeared on different parts of the body; he became delirious, had continual tremors, and weak quick pulse. On the *fourteenth* day the face had become purple, the lips dry, and he was very comatose: large and distinct spots appeared on the inside of the arms, and the hands were swollen and bluish: the whole of the limb which had been operated on was enormously swollen; the extremities became cold, and he died the same morning. The only important points in the *examination* were the fluidity of the blood, and the enormous distension of the *vena cava;* incipient ulceration in the intestines: the vein which had been tied had not been perfectly obliterated. (pp. 442, 43).]

1532. *Lateral compression of the vein* (according to BRESCHET's practice in *Varicocele*) has been performed by SANSON (*a*) by means of forceps, between which a pair of metal plates, fifteen lines long, covered with leather, which compressed the vein, raised up in a fold of skin sufficiently to prevent the blood circulating through it. The forceps are to be frequently applied at different places, so that no slough should be formed. A plug of blood is thus produced, which stops up the vein.

1533. In reviewing these different modes of treatment for the radical cure of *varix*, it must be remembered that in all those accompanied with wound of the vein, there is danger of venous inflammation arising, which often spreads widely and causes death. This is the more important, as persons who are subject to varix have, for the most part, accompanying gouty or rheumatic affections, stoppage, and fulness in the belly, and extensive alterations in the venous system at the same time, whence they are the more disposed to such inflammations; so that it must not be overlooked that, on account of the causal relations of *varix* to such general diseased conditions, it often belongs to the relative well-being of the patient, and that after its removal other symptoms set in, or expansions in other parts of the venous system occur. Such radical cure of *varix* must therefore never be undertaken without careful review of the patient's general condition, and never without important reason, and pressing demand. In old persons it has never any benefit. Puncture is least dangerous; but, in regard to its result, a radical cure, very uncertain. Tying and incision most frequently set up dangerous inflammation; less so do extirpation and the introduction of threads. But even in the latter seemingly trifling proceeding, inflammation of a very severe degree may ensue, though less after the simple introduction of the needle or thread, (KUH, FRICKE,) than in tying the vein at the same time, (DAVAT, FRANC, and others,) in which the circulation through it is entirely arrested. In this respect the simple compression of the vein, after SANSON's plan, deserves especial notice, if further observation should prove the certain closure of the vein thereby.

(*a*) Gazette Médicale, 1836. Feb. Hamburg. Zeitsch., vol. ii. pt. ii. p 250.—FRORIEP's Chirurgisch. Kupfertaf., pl. ccclxxxvi.

II.—OF VARICOCELE.

(*Varicocele, Cirsocele.* Lat.; *Krampfaderbruch, Saamenaderbruch, Saamenadergeschwülst*, Germ.; *Varicocèle*, Fr.)

Richter, Observationes chirurgicæ, fasc. ii. p. 22.

Ibid., Anfangsgründe der Wundarzneikunde, vol. vi. p. 165.

Murray *resp.* Bonsdore, Dissert. de cirsocele. Upsal, 1784.

Leo, F., Dissert. de cirsocele. Landish, 1826.

Benedict, Ueber Hydrocele, Sarcocele und Varicocele. Leipzig, 1831.

Landouzy, above cited.

Fritschi, J., Ueber die Radicalkur der Phlebectasia spermatica interna oder sogenn. Varicocele, u. s. w. Freiburg, 1839.

1534. *Varicocele* or *Cirsocele* is a varicose expansion of the veins of the spermatic cord, and in a more advanced state of those also of the *epididymis* and testicle. The disease always commences in the spermatic cord, and generally makes itself known by a heavy, often smart pain, which from time to time darts to the testicle and loins; the ailment, however, frequently develops itself without any inconvenience. An irregular swelling, consisting of several threads, is felt along the course of the spermatic cord, which diminishes on slight compression. In proportion as the swelling gradually increases, it approaches nearer the testicle, which enlarges, and becomes heavier; by degrees the varicose condition extends to the *epididymis*, and thence to the testicle itself, which is loosened into a soft, doughy mass, and presents only a convolution of expanded vessels, probably simultaneous thickening of their walls, and of the cellular tissue connecting them. The purse also is expanded, and the patient feels a troublesome or painful weight in the testicle, which sensation extends to the loins, especially when it has existed a long time. The characteristic signs of *varicocele* are the ready disappearance of the swelling on compression, its quick reappearance when the pressure is withdrawn, as well as its increase on long-continued standing. As these appearances belong to ruptures, and as in a large *varicocele* the swelling enters the abdominal ring, by which it is enclosed, and its condition, when touched, has resemblance to that of omental rupture, the history of the disease, and the characters already described (*par.* 1200) must give the *diagnosis.*

The words *cirsocele* and *varicocele* are used with different significations. Many writers apply the former only to a simple swelling of the superficial veins of the purse; but the second to a swelling of the spermatic veins. Some employ *varicocele* in this double acceptation, and *cirscocele* as a swelling of the vessels of the *epididymis* and testicle: again, others consider both designations as of similar import.

According to Breschet (*a*) *spermatocele* is a swelling of the spermatic cord, and especially of the *epididymis*, depending on retention of the *semen*. It begins with a sensation of pressure, distension, and more or less severe pain. If the *semen* be not voided by pollution or by connexion, inflammation, bursting of the swelling, and actual fistula ensues, which is characterized by the escape of the *semen* (1). This affection of the *epididymis* is especially observed in *gonorrhœa*, and the swelling of the testicle ensuing in proportion to the decrease and entire cessation of the *gonorrhœa*, which always begins in the *epididymis*, depends on the retention of the *semen*. In this spermatocele, connexion, moderate living, avoidance of exciting the imagination, cold washes to the generative organs, and, in inflammation, the application of leeches are to be recommended. In fistula nothing can be done directly.

[(1) Spermatocele is often a sore nuisance to young people; the testicle become so exceedingly tender that the mere pressure of the dress upon it causes great pain. It is not generally accompanied, at least in the cases I have seen, with much swelling and I have never seen it followed by suppuration, as Breschet states. But I have known it

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(*a*) Observations et Réflexions sur la Fistule spermatique ou Spermatocèle; in Journal général de Médecine, 1826, June, p. 348.

recur very frequently, at intervals of two or three months, for as many years, between sixteen and two or three and twenty. I do not believe it will have usually the results stated; but it is a most troublesome and annoying complaint, compelling the patient to keep himself completely at rest, and is not very easily controlable. Keeping the bowels free, and avoiding excitement of all kinds, bodily or mental, with a cool dressing, and supporting the testicles with a suspensory bandage, is almost all that can be done; and that not of much benefit. Usually after a time it is outgrown, and the disposition to it ceases.—J. F. S.]

1535. The causes of varicocele are various, though in some cases often not at all determinable. For the most part it depends on weakness of the spermatic veins, produced by great congestion, in consequence of venereal excesses, onanism, or from long-continued libidinous appetite, or after previous inflammation of the testicle, from obstructed return of the blood in persons of sedentary habits, in swellings and costiveness of the bowels, from a truss pressing the spermatic cord, from particular employments, and so on. The disease occurs more frequently on the left than on the right side, the ground of which is to be sought for in various causes (1). Sometimes it is accompanied with hæmorrhoidal inconvenience. The disease is most commonly noticed in young persons, from fifteen to thirty years of age, rarely in older people. In many cases, however, the ætiology of this disease is quite obscure, and it is indeterminable what share the above-mentioned causes have on its origin. The complaint often remains in a slight degree stationary, although, on account of the mode of living and employment of the patient, its increase is on every ground to be feared (*a*).

(1) Many derive this disease from pressure of the sigmoid flexure of the *colon* on the vessels of the spermatic cord. MORGAGNI and A. COOPER place the cause in the entrance of the spermatic vein of the right side into the *vena cava ascendens*, in an almost parallel direction with that vessel, whereby its emptying is more readily effected; whilst the vein on the left side terminating in the emulgent vein, the circulation produces an obstacle, as the two streams do not take the same direction. The length of the veins of the spermatic cord, on the left side, has also been charged with it, as well as the narrowing of the mouth of the left inguinal canal, in consequence of the contraction of the abdominal muscles, in the exertion of raising weights, on account of the bending over to the right side (LENOIR.)

1536. If the disease be left to enlarge, it changes the structure of the testicle by overspreading it, rendering it useless for its function, or atrophic: by the enlargement of the swelling are produced swellings of the veins of the purse, inconvenience from its weight, and not unfrequently considerable pain, especially on long-continued standing, or any overexertion, and even the impossibility of walking without a suspender. In general there is also a greater secretion of the scrotal skin. Where a quick course of the disease, with violent pain and speedy wasting of the testicle have been observed, (POTT, A. COOPER,) it appears to depend less on the varicocele than on another and indeed traumatic influence.

1537. The *treatment* of varicocele must principally depend on its cause, and when this is known, it must be removed according to the general rules laid down. In a trifling degree of the disease, the purse may be supported by means of a well-fitting suspendor; and by the repeated use, during the day, of cold astringent applications of lead wash, solution of alum, aromatic decoctions, frequent washings with these remedies, or with cold water and spirits of wine, or with *liq. mineralis* HOFFM., naphtha, and so on; even blisters may be applied to the purse to increase the contractility of the part. The patient must at the same time

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(*a*) DELPECH, Précis élémentaire, vol. iii. p. 266.

avoid all exertion, constant standing, and walking; and especially he must properly regulate his living. In most cases, however, the inconvenience of the patient is only lessened, and a check given to the progress of the disease.

1538. In the more advanced state of varicocele, if it cause considerable inconvenience or be connected with rupture, various modes of treatment have been proposed with a view to the radical cure, as extirpation of the varicose vessels, tying all (1), or a single bundle of the swollen veins (2), tying the spermatic artery (3), carrying through threads or needles, or a simultaneous surrounding of the latter with threads (4), excision of a part of the purse or its inclusion in a ring (5), the ensheathing of the skin of the purse (6), and the continuance of pressure by means of a compressor or a pair of forceps (7).

(1) According to CELSUS the superficial veins were cauterized with a pointed iron, and the whole bundle of deep veins tied and extirpated. In the same way have PARÉ, HEISTER, PETIT, CUMANO, KEY, and others, proceeded with some modification, in which they have only removed the veins, or even the testicle itself.

(2) CHARLES BELL considered the separate tying of one or more venous strings sufficient. The veins are to be laid bare by a longitudinal cut through the skin and general scrotal covering, one of the largest venous strings grasped with the fingers, separated and tied with a thread. When this disease is very large, two and even three strings must be tied; and the wound closed. The ligatures separate in a few days.

DELPECH (*a*) divides the skin by a cut of two inches long, parallel to the spermatic cord, cuts through the *m. cremaster* and sheath with the forceps and bistoury, raises one vein from the rest, isolates it, passes under each a piece of thick soft German tinder, and then puts a single ligature on the latter. The ligature is only to be drawn so as merely to bring the walls of the vein together, and prevent the flow of blood through it; whereupon great swelling of the varicose vein ensues. The wound is to be lightly filled with lint and covered with a softening poultice. The ligature is to be removed on the third day. DELPECH has noticed, after the performance of this operation, the restoration of the function of the testicle.

TAVIGNOT's subcutaneous ligature in the way already mentioned. (*par.* 1432.)

(3) MAUNOIR, (*b*), BROWN (*c*), AMUSSAT (*d*) and JAMESON (*e*), have tied the spermatic artery successfully, but GRAEFE (*f*) without success. According to MAUNOIR, the cut should be made half an inch long, below the abdominal ring in the course of the cord, its sheath opened, the artery separated, a double ligature applied, and the vessel divided between them. If the varicocele exist in such degree that simultaneous loosening of the spermatic cord and testicle expand the *scrotum* to a large swelling, this proceeding is more difficult, and it would be better to make, close above the external abdominal ring, a cut two inches long, obliquely upwards and outwards, to cut through the outer walls of the inguinal canal, to open the sheath of the exposed spermatic cord with a shallow incision, and carefully to separate the artery. In this case it must not be overlooked that the spermatic artery also divides below the external ring (*g*).

(4) According to FRICKE a part of the purse should be grasped with the left hand, so that one of the expanded veins may be found between the fingers, upon which with a common needle the skin and vein are to be pierced obliquely, and a thread introduced which is to be tied upon the skin. This operation, which may be repeated on one or two other veins, is easily performed and little painful. The purse should be kept horizontal and supported on a pillow. If, on the next day, redness of the skin and sensibility of the testicle occur, the thread is to be withdrawn. The swelling gradually subsides, and the veins are converted into solid strings, free from pain.

According to KUH (*h*) every single vein of the *plexus*, on both sides of the purse, is to be grasped with the fingers and perforated with a needle, each needle to be ensheathed in a proper cork, and the purse supported with compresses or a suspender.

(*a*) Mémorial des Hôpitaux du Midi, 1830.—Journal von GRAEFE u. WALTHER, vol. xvii. p. 329.

(*b*) Nouvelle Méthode de traiter le Sarcocèle, sans avoir recours à l'extirpation du testicule, etc. Genève, 1820.—Journal von GRAEFE und WALTHER, vol. iii. p. 369.

(*c*) New York Medical and Phys. Journal, 1824, March.

(*d*) La Clinique des Hôpitaux, vol. iii. No. 82.

(*e*) Medical Recorder, 1825, April, p. 271.

(*f*) Klinischer Jahresbericht, 1822.

(*g*) DIETRICH, above cited, p. 448.

(*h*) Above cited, p. 53.

According to DAVAT and FRANC (*a*), the varicose veins should be separated from the *vas deferens*, and one or two needles thrust between them; a waxed thread is to be twisted several times round such needles, and tied fast, by which the vein is constricted and obliterated. FRANC believes that two days, and even a shorter period, is sufficient to produce complete obliteration of the vein. RAYNAUD's practice (*b*) agrees with this, but that he applies a linen cylinder on the skin, upon which he ties the threads together; by tightly tying, he divides the spermatic cord till the skin alone remains undivided, which, after the ligature has been drawn out, is divided upon a director, and the superficial wound heals quickly afterwards.

(5) WORMALD (*c*) passed the lower part of the purse through a soft, wide silver ring, an inch in diameter, and covered with leather, whilst the patient reclined, and the veins were empty, and fastened it so tightly together that the parts could not escape. This was done every morning, whereby inconvenience was avoided. A. COOPER (*d*) objects to this proceeding, and recommends cutting off a sufficiently large flap of skin from the purse, after which the suture is to be so applied that the lower flaps of the wound should support the testicle like a suspender. By this means the varicocele is diminished, though not removed, but all inconvenience is got rid of.

(6) In a similar manner the ensheathing and shortening of the purse, proposed by LEHMANN (*e*), acts. The whole of the front of the purse is thrust up with the forefinger of the left hand, so high beneath the skin of the belly, till the bottom of the purse is brought above the horizontal branch of the share-bone, and the testicle lies pretty close to the belly. GERDY's rupture-needle, armed with a double thread, is then introduced into the bottom of the ensheathed canal, the purse, and the over-lying skin of the belly, penetrated with its point, so that the eye with the threads may project some lines. With the assistance of a pin, the end of one thread is to be freed from the eye and the needle being drawn back, is then thrust through again in the same way, half an inch deeper, and the other end of the thread pulled out. The ensheathed skin is drawn with the thread loop so close to the belly, that the testicle lies hard by it. The two ends of one thread are then tied upon a wooden cylinder, as big as a crow quill, about an inch and a half long, and covered with sticking plaster; and afterwards the other.

(7) BRESCHET (*f*) has proposed a simple and certain mode for employing compressors, both for the swollen veins of the purse, and also for those of the spermatic cord; and from his practice are, to a certain extent, those of a recent date derived.

Compare also LANDOUZY, above cited.—ROGNETTA; in Bulletin de Thérapeutic, vol. vii. pt. i.

1539. Of these various modes of treatment for the radical cure of varicocele, both according to my own and others' experience, that proposed by BRESCHET as regards its easy employment, its applicability to the different stages of the disease, its certainty, and its freedom from danger, is to be esteemed the most proper and the most preferable. Extirpation of the testicle, and tying the whole bundle of veins, can bear no comparison with it. Tying the separate veins as proposed by BELL, has not been supported either by others' or by my own experience; and BELL himself subsequently did not advise it (*g*). Tying the spermatic artery is very difficult, often scarcely possible, on account of its intimate connexion with the other tissues of the cord, without injuring them, and on account of the variety of its ramifications uncertain in its result. Piercing the veins with needles or threads often risks the danger of inflammation and has uncertain success. The introduction of one or several threads, or of a single thread below the bundle of veins, may also produce severe symptoms, is more tedious, more painful, and consequently less favourable than the practice of BRESCHET (*h*). The drawing into a ring, and cutting off flaps of the scrotal skin, are merely palliative.

(*a*) Above cited.

(*b*) Gazette Médicale, Dec. 1837.—FRORIEP's, N. Notizen, Febr. 1839. No. 99.

(*c*) London Medical Gazette, 1838, April.

(*d*) Guy's Hospital Reports, 1838, p. 9.

(*e*) Pr.-Vereinszeitung, 1840, No. 49, 50.

(*f*) Mémoire sur une nouvelle Méthode de traiter et de guérir le Cirsocèle et le Varicocèle, lu à l'Académie des Sciences le 13 Janvier, 1834.

(*g*) BELL, CHARLES, vol. i. p. 95.

(*h*) DUFRESSE, above cited.—LANDOUZY,

1540. In order to include all the veins, in the operation after Breschet's method, the patient must walk about for some hours previously in summer, and in winter keep in a very warm bed, by which the veins are filled with blood. The purse is to be shaved, and the patient placed in front of the operator, who with his left hand grasps the right side of the purse, with the fore and middle finger behind, and the thumb in front, with its tip on the *septum*, whilst the two fingers support the testicle; the finger of the right hand is to be applied to the left side of the purse, so that the fingers may touch. The *vas deferens* is now to be found, which is easily done, in consequence of its position at the back of the cord, its string-like character, its equal thickness (that of a crow quill,) throughout, its hardness but elasticity, and by its peculiar painfulness when pressed. The *vas deferens* is now to be kept back with the finger and thumb against the *septum*, whilst the veins are drawn out from it with the same fingers of the right hand, in doing which especial care must be taken that not a single vein remain with the *vas deferens*. The *penis* is to be kept by an assistant lying upwards upon the belly, for the purpose of preserving on its under surface a sufficient length of skin, so as to prevent painful distension in the often recurring erections. The compressing forceps are then to be applied, first the upper as high as possible on the purse, though at sufficient distance from the *penis* as not to produce excoriation; the under one half an inch below the first, without, however, touching the testicle. The forceps are applied so across, that their arms grasp nearly the whole breadth of the left side of the purse, up to the *septum*, that the *vas deferens* remains unenclosed, and only the outer edge of the purse, to the breadth of from two to three lines, without the veins, is contained in the space between the arms of the forceps, and when they are closed is not squeezed. The arms of the forceps are now closed as tightly as possible with a screw, then by means of more violent pressure on a narrower space, a concealed plate on the upper arm is pushed forwards next the screw on the *septum*, and then that on the other arm screwed tight. The patient is then put to bed, the forceps kept against the belly by long strips of sticking plaster, and the purse supported with a cloth or with a ball of lint.

The same method serves for the left side, on which varicocele is most frequent, as that described for the right side, only the position of the hands is reversed.

For the above described compressing forceps, and their mode of application, see Landouzy, f. 1, 2, 3. Breschet's original forceps, their improvement by a movable plate. to effect pressure on three sides. I have employed the latter always with the best result.

1541. In the first hours after the operation, the patient feels a sharp pain in the purse and in the groin, but this subsides. Applications of lead-wash are to be made to the purse. When on the second or third day the forceps become loose, the plate is to be screwed tighter, which, if it be now only as at first properly done, does not cause much pain. When suppuration ensues, between the fifth and sixth days, the forceps are to be removed, and the remaining suppurating parts treated simply. If painful erections of the *penis* take place, which are most surely prevented by keeping the *penis* against the belly during the application of the forceps and subsequently, which I have never practised in my operations, small doses of camphor, with nitre, may be employed. The time necessary for the cure varies between three and six weeks. It is advisable, for some months after the cure, to wear a well-fitting suspender, and to use the cold bath and lead washes.

III.—OF HÆMORRHOIDS OR PILES.

Hæmorrhoids, Lat.; *Hæmorrhoidalgeschwülste*, Germ.; *Hémorrhoïdes*, Fr.

THEDEN, Chirurgische Wahrnehmungen, vol. i. p. 56.

RICHTER, Anfangsgründe, vol. vi. p. 393.

ABERNETHY, Surgical Works, vol. ii. p. 231. New Edition. 1815.

KIRBY, J., Observations on the Treatment of certain severe forms of Hæmorrhoidal Excrescence. Dublin, 1825. 8vo.

COPELAND, T., Observations on the principal Diseases of the Rectum and Anus. London, 1814. 8vo.

WHYTE, W., Observations on Strictures of the Rectum and other Affections, etc. Third Edit. Bath, 1820. 8vo.

HOWSHIP, J., Practical Observations on the symptoms, discrimination, and treatment of the most common Diseases of the Lower Intestines and Anus, etc. London, 1820. 8vo.

DUPUYTREN, De l'Excision des Bourrelets Hémorrhoidaux; in Leçons Orales de Chirurgie Clinique, vol. i. p. 339.

BRODIE, SIR BENJAMIN, On Hæmorrhoids; in London Medical Gazette, vol. xv., 1835.

BUSHE, GEORGE, M. D., A Treatise on the Malformations, Injuries, and Diseases of the Rectum and Anus. New York, 1837. 8vo.

SYME, JAMES, On the Diseases of the Rectum. Edinburgh, 1838. 8vo.

1542. *Hæmorrhoids* or *Piles* are varicose expansions of the veins in the lower part of the *rectum*, in which, by the collection of blood in these vessels, unnatural bags and sacs of different size, from that of a pea to that of a walnut, are produced. These swellings are commonly called *blind piles*, (*Hæmorrhoides cæcæ*,) to distinguish them from *flowing piles* (*Hæmorrhoides fluentes*, *apertæ*); they swell periodically, and again become lax, so that only the empty bags remain. If they have considerable size, they are called *sac piles* (*Hæmorrhoides saccatæ*); if small, *tubercular piles* (*Tubercula hæmorrhoidalia.*) The blood coagulates in the sacs often into a hard mass, so that a firm swelling is formed.

Only when these swellings are not very large, may they be formed simply by expansion of the walls of the veins; but if they be of greater size, the blood is poured out beneath the inner coat of the *rectum*, and expands it into a sac; hence the large size which the swellings often attain. It often happens that in cutting them off little or no bleeding occurs, and it is then distinctly perceived that they consist only of skin. They have also frequently a peculiar form, which *varix* cannot so easily acquire. This is proved, especially by KIRBY's careful observations, viz., that these excrescences do not consist of expanded veins, but of a sac-like lengthening of the thickened cellular tissue, surrounded with some veins, and covered with the integuments of the folded margin of the *anus*. The veins are branches of the internal *iliac*. In every case of internal piles the structure was the same, but the veins appeared wider, and were branches of the hæmorrhoidal vein. BRODIE, on the contrary, asserts that in all cases he found the hæmorrhoidal knots only as expanded veins. In those of larger size more indeed than simple expansion of the veins is found, as there is effusion of lymph and thickening in the neighbourhood of the expanded vein.

1543. These swellings are often seated on the outer edge of the *anus*, or on the inside of the *rectum*, in the region of the *m. sphincter ani* or above it.

1544. The consequences resulting from piles are, *inflammation and suppuration*, *discharges of mucus* from the *rectum*, and *considerable bleeding*. If these swellings attain a large size, if, on going to stool, the piles within the *rectum* be protruded, they are often grasped by the aperture of the *anus*, swell considerably, are protuberant, and very painful. The pain often spreads over the whole belly, and the patient feels extremely painful *tenesmus*; the piles even become gangrenous. If they go on to suppuration, in which case syphilitic causes are mostly in play, suppuration may easily spread into the loose cellular tissue of the *rectum*, producing great destruction and fistula. Not unfrequently do these piles become converted into a hard fleshy mass, and even into cancer.

[BUSHE has detailed an awful account of the symptoms of piles, most of which, however, result from the constitutional excitement they produce when inflamed, and are then occasionally very severe. The local symptoms are well described by him:—"A feeling of weight in the loins, hips, and groins; dull throbbing pain in the *rectum*, attended with a sense of increasing heat, *tenesmus*, mucous discharge, and occasional darting sensations, resembling those of electricity; itching of the *anus*, and finally painful, difficult, and frequent micturition."—(p. 146.)

"Frequently the loss of even a small quantity of blood," observes BUSHE, "relieves the feeling of weight and tension in the *perinæum*, *rectum*, and lower part of the back, as well as any other disagreeable symptoms which may have existed. The amount of hæmorrhage, however, is not always in proportion to the severity of the symptoms denoting the loaded state of the hæmorrhoidal vessels—the quantity being sometimes very great, though not preceded by well-marked premonitory signs; while, in other cases, the discharge of blood is trifling, notwithstanding the fluxionary movement may have been well marked. Generally it ceases after a few days; yet not unfrequently it continues for months. In some instances it occurs but once in life; again, it may return in the course of a few weeks, months, or even years. Occasionally it assumes a periodical character, returning with the season or the month. The amount of blood lost varies; a drachm, an ounce, or even a pint may be discharged at a time, though it must be confessed, that the admixture of other fluids is apt to impose, upon the inexperienced, the belief that the loss of blood is much greater than it really is."—(pp. 146, 147.)]

1545. The *causes* of hæmorrhoids, besides predisposition, which is ascribed, to walking upright, to the difficult flow of the blood into the portal system, which is unprovided with valves, to hereditary habit, and to the flow of blood into the abdominal organs in advanced old age, are stoppages and costiveness of the intestines, much sitting, pressure of the pregnant womb, local irritation of the *rectum* from hard stools and continual riding, or of the neighbouring parts; for instance, of the bladder in urinary stone, and so on.

1546. The *treatment* of hæmorrhoids is various, according to the circumstances in which they are found. If they be inflamed, cooling remedies must be employed, cream of tartar with sulphur, leeches to the *perinæum*, cold applications; and if these cannot be borne, mild ointment and soothing fomentations. If the inflammation result from strangulation of the piles, their return must be attempted with the finger oiled, the patient being placed with his rump raised high, and all pressure removed; and if this be not easily effected, to empty them with a simple lancet cut. If they suppurate, the abscess must be soon opened to prevent burrowing of the pus, and if the ulceration depend on a syphilitic affection, the proper local and general remedies must be employed. If the bleeding from the hæmorrhoidal vessels be very severe, so that the patient is much weakened or his life endangered, rest and the horizontal position, best on a hard mattress, is to be recommended; internally, milfoil or other astringent remedies; externally, cold hip-baths, cold water with vinegar or spirits of wine, cold decoctions of astringent vegetables, or solution of alum and the like, may be employed as injections into the *rectum*, or as fomentations with a sponge. If these means be not of use, and the danger pressing, the bleeding must be stopped by plugging in the way described (*par.* 934.)

1547. If the piles produce by their size or hardening constant inconvenience, bloody, mucous, or purulent discharges exhausting the patient's powers, continual pain, and the like, if they be external to the *rectum*, or project at every time of going to stool, and prevent the discharge of the motions, their removal is indicated. It is, however, to be remembered, that after the destruction of the piles by the reflection of inflammation upon the other veins, their tone is raised, and thus in part the cause of the hæmorrhoids is removed. Where, however, they are a healthy habitual emptying, or when they have causal relations with incurable diseases, as, for example, *phthisis pulmonalis*, we must be cautious with their removal; it must either be not undertaken at all, or, at least, all the piles must not be removed at once.

1548. Extirpation of the hæmorrhoids has been proposed in three different ways. *First.* A ligature to be applied around the base of the whole swelling, and this gradually, and not at once, tightened, till the knots have fallen off (1). *Second.* The external skin of the pile is to be divided with a cut down to its base, and separated on both sides from the under-lying skin, which is to be cut off with scissors. The advantage of this practice is, that the remaining external skin covers the seat of the vein, and prevents the bleeding. *Third.* The pile is to be grasped with the forceps, drawn forwards and cut off with scissors in such way that some still remains on the base, by which the wound is partially covered. In external hæmorrhoids, the cut is to be made in the parts below the *sphincter*. The entire surface of the wound retracts into the *rectum*, and by the action of the *sphincter* is contracted, whence the danger of bleeding is very much diminished. If the wound be retracted above the *sphincter*, internal bleeding may take place. This practice is easy, and preferable to the others, as after the ligature there is often severe pain, inflammation, vomiting, retention of urine, and so on; as the division of the external, and the extraction of the internal skin, is always difficult, and in many cases, on account of their union, impossible. The large hæmorrhoids, also, are mostly formed by effusion of blood beneath the internal coat of the *rectum*.

(1) Rousseau, J. C. (*a*), passes a needle with two threads of *different colours*, from the *anus* outwards, through the swelling; then two-thirds of an inch farther back again from without to the *anus*, thus leaving between the stitches a loop of three or four inches long, and thus carries it around the whole swelling. He then cuts through the loop of the one colour to the outer, and that of the other on the inner side towards the *anus*. In this way is each part of the swelling surrounded with a ligature, which is to be drawn tight, and cut off short. If the swelling be large, the dead part, when it has become insensible, is to be removed, but not too close to the ligature. The ligatures usually fall off in seven or eight days.

Delpech (*b*) divided with a single cut the fibres of the *sphincter* muscle towards the *coccyx*, introduced a pessary, and let it be drawn with a string attached to it by an assistant, by which the swelling was reversed and cut off with a scalpel, but was then introduced, the string carried through the opening of another pessary, and tied upon a piece of wood so as to compress the *anus* between the two pessaries.

[Copeland and Brodie lay down as a general rule that internal piles should be removed by ligature. Bushe also prefers this mode, and says:—"I have now perperformed it, I am sure, upwards of a hundred times, and I have never seen a bad symptom follow it." (p. 187.) And Syme observes:—"I feel warranted, after very extensive employment of ligature, to state, that it may be used without the slightest risk of serious or alarming inconvenience." (p. 76.) It must not, however, be forgotten that serious inconvenience and fatal results will, occasionally, follow the application of

(*a*) Annual Medical Recorder, vol. ix. p. 282.
(*b*) Mémorial de la Clinique de Montpellier, 1830, Sept. p. 545.

the ligature to piles. **Petit** (*a*) mentions the case of a woman in whom, under very favourable circumstances, he tied three piles, which at first did not cause much pain; but, five hours after, she was attacked with violent colicky symptoms, for which she was bled four times without benefit; the ligatures were then removed, the symptoms yielded, and the patient recovered. In another case related by **Petit**, five ligatures were applied at once, inflammation and swelling of the belly, vomiting and hiccough ensued; the ligatures were removed, but the patient died. And he observes:—"I compare these symptoms with those, accompanying a rupture, in which a small portion of intestine is strangulated; if this kind of rupture be not speedily relieved, the patients die, sometimes in thirty or forty hours, of gangrenous inflammation of the whole belly, but particularly of the intestines; thus this patient died before the conclusion of the second day." (p. 125.) **Kirby** mentions two similar cases, one of which was scarcely saved, and the other died of *tetanus*. **Brodie** relates two fatal cases after ligature, in one of which the patient died, "in consequence of diffuse inflammation of the cellular membrane running up on the outside of the gut as high as the mesentery; but it was in a constitution broken down by long-continued hæmorrhage, and in whom any slight accident might have produced equally bad consequences." In the other case, the patient, "a week after the operation, and having been quite well in the interval, had an attack of pain in the *abdomen*, and shivering attended with fever, and died. An examination of the body not having been allowed, the precise cause of death was not ascertained." p. 844.

"The safest and best way," says **Copeland**, "is to pass a ligature round one only of the tumours at a time, the most painful and troublesome of them, and to wait until the patient has quite recovered from this operation before anything more be attempted, if anything more should be still necessary. * * * It is better that this operation by ligature should be repeated two or three times, if it should become necessary, than that the tumours should all be removed at once, at the imminent risk of the life of the patient." (pp. 64, 5.)

It is right that the day before the operation the patient's bowels should be cleared with castor oil or rhubarb, which prevents the necessity for disturbing them for a few days afterwards. **Brodie** recommends that the piles should be well protruded by sitting "over a pan of hot water, which will relax the *sphincter* muscle, and at the same time cause the veins of the *rectum* to become filled with blood. If this be not sufficient, let the patient have a pint or two of warm water thrown up as an enema, and when that comes away, the piles will probably descend. * * * Let the patient lean over a table, or lie on one side in bed, with his knees drawn up, the *nates* being held apart by an assistant. Each separate pile must be separately tied. If it be of a very small size, you may just take it up, with a double tenaculum, draw it out, and tie a ligature round its base. But if the piles be of large size, a large curved needle, armed with a strong double ligature, is to be introduced through the base of one of the piles, and the needle then cut off. The double ligature is now divided into two single ones, which are tied round the base of the pile; one on one side, and the other on the other, with a single knot. * * * When each pile is thus secured, cut off the convex portion of each pile, so as to make an opening into the cavity of the convoluted vein which forms it. Thus you take off the tension produced in the pile by the blood which it contains, and are enabled to draw the ligature tighter than before. It should be drawn as tight as possible; for then the subsequent pain will be less, and the separation of the slough quicker. A double knot having been made on each ligature, the threads are to be cut off close to the knots, and the piles, and the remains of the ligatures returned into the *rectum*. In about a week the ligatures are generally detached; and at this period the bowels should be kept gently open with lenitive electuary and sulphur, and cold water be thrown up the *rectum* every morning, in order to prevent a recurrence of the disease." (p. 844.)]

1549. The extirpation of the large swellings, degenerated piles, is performed in the following way. After the bowels have been emptied by a purge, and shortly before the operation by a clyster, the patient is to be placed on his belly with his buttocks raised, or upon his knees and elbows, or upon the side, in which case the opposite thigh is to be drawn up towards the belly, and the buttocks separated by an assistant. In internal piles, the swelling having been protruded by the pressure and straining of the patient, also after the employment of a warm hip or vapour bath, is to be grasped with broad-bladed forceps drawn forwards, and the *projecting part* cut off at one or more strokes with curved scissors. In the

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(*a*) Œuvres Posthumes, vol. ii.

same manner external hæmorrhoids are to be treated. The most important thing to be dreaded, after the operation is bleeding; often is it inconsiderable, stops of itself, or can be stanched with cold water. When it is more severe, it may be most certainly stanched by cauterizing the bleeding part with a bean-shaped iron. The patient must always at first be attended by an experienced assistant, as after-bleeding, especially if it be not cauterized, is always to be dreaded (1). After the removal of an internal pile, there may be imminent danger without it being noticed. The patient always feels an increased warmth in the *rectum*, which is accompanied with the symptoms of concealed bleeding. A cold clyster must be immediately given; by straining and forcing, the blood must be discharged, and the bleeding part protruded, upon which the hot iron is to be applied. The inflammatory and spasmodic symptoms, as fever, colic, retention of urine, and so on, which soon come on after the operation, especially if cauterization be employed; must be got rid of according to circumstances by blood-letting, fomentations to the belly, introduction of the catheter, and anti-spasmodics. After the removal of large hæmorrhoidal swellings, a moderately thick bougie, smeared with cerate, must be introduced from time to time, to prevent a narrowing of the *rectum* (2).

Plugging the *rectum* may, indeed, be employed for stanching the bleeding; inconveniences are, however, connected with it, especially the continual pressure, extremely tiresome to the patient. The plug is also easily displaced, and its effect is not so certain as that of the hot iron (*a*).

[(1) When the bleeding after the removal of internal piles is profuse, and the patient will not submit to the actual cautery, Bush advises the use of an instrument which he "had constructed for suppressing hæmorrhage after lithotomy. This instrument is seven inches long, tubular, about as thick as a swan's quill, terminated with a button at one end, to facilitate its introduction, and with a stop-cock at the other. One inch from the stop-cock, and half an inch from the button, there are two projecting rings, and on the proximal side of the distal ring the tube is perforated by a number of holes. Finally, a portion of intestine is bound by means of waxed silk on the tube, behind the ring. This instrument should be introduced, and then inflated. In some little time we can let off the air and withdraw the instrument, provided the hæmorrhage has ceased; but if we find that it returns on the removal of the pressure, we must again inflate the intestine." (p. 185.)

(2) The elder Cline was accustomed to cut off piles; and Astley Cooper (*b*), for a time, followed the same practice, "thinking excision the best mode, because he found the pain produced by it very trifling as compared with the ligature." (p. 75.) But he met with several fatal cases from this method, which he very candidly mentions. In one case, "a very few days after removal of internal piles with the scissors, the patient complained of pain by the side of the *rectum*; an abscess formed under the *glutæus* muscle, which discharged abundantly: his constitution was already broken up, and he died in consequence of the discharge." In the second case he had removed internal piles, by excision, from a nobleman, without ill consequences; but, two years after, a similar operation having been performed on the same person, it was followed by frequent desire to go to stool, and four times he discharged a considerable quantity of blood. On examining, with a *speculum ani*, "one of the hæmorrhoidal arteries in the centre of one of the piles, which had been removed, was found divided." Cooper took it up; but the patient, being advanced in years and much weakened, was attacked with a severe rigor, grew gradually worse, and in four days died. The third case, operated on by another Surgeon, died from bleeding, on the fourth day. In the fourth case mentioned by Cooper, there was not any hæmorrhage; but, three days after, the woman was attacked with peritonæal inflammation, and died ten days subsequent to the operation. On *opening* the body, the *peritonæum* was found much inflamed, and had the appearance of death from puerperal fever. (p. 75-7.) Brodie employed excision for a time, but afterwards had three cases in which considerable quantities of blood were lost, and in the last, he observes, "so much, that he only wondered the patient did not actually die." Since then he has "never removed large internal piles except by ligature." (p. 843.)

(*a*) Dupuytren, above cited.

(*b*) Lectures on Surgery; in Lancet, 1823, 24, vol. ii. Third Edition. 1826.

THIRD DIVISION.

DISEASES DEPENDENT ON UNNATURAL COHERENCE.

First Section.—ON UNNATURAL COHERENCE IN GENERAL.

1550. The unnatural coherence of organic parts consists either in the union of neighbouring parts, which naturally are distinct; or in the formation of bad scars which diminish or destroy the movements of parts, by preventing their extensibility; or in a narrowing or closing of their outlets, by which their functions are considerably disturbed or rendered quite impossible. They are specially either consequences of previous inflammation, or vices of the original formation and congenital.

1551. In order that parts, which in their natural state are distinct, should unite together, a proper degree of inflammation, destruction of the skin, and long continued close contact are required. The union is either immediate, by means of a scarcely perceptible, interposed layer of plastic lymph, into which the vessels shoot; or it is fleshy, and depending on the development of granulations, and the formation of an intermediate substance, oftentimes having perfect resemblance to the parts it connects; or the connecting interposed matter is fibrous, membranous, in which case it would seem that there had been previously a more intimate connexion, which, in consequence of the movements of the connected organs, had formed these membranous lengthenings. For example, in the band-like adhesions between the *peritonæum* and the surface of the intestines, between the pulmonary and costal *pleura*. All organs are, under the above-mentioned conditions, capable of union; the serous structures and synovial membranes are most prone to it, the mucous membranes least so, and only when their surface is destroyed, and the underlying cellular tissue laid bare.

1552. When in a wound accompanied with loss of substance, especially in a severe burn, the treatment has not been conducted with due care, and the parts kept in proper position, the edges of the skin either greatly contract towards the centre, and a tough cord-like scar often connected with the underlying parts, or a superficial, prominent, knotty, misshapen scar is produced. In consequence of this the position and movements of the part are in various ways damaged or completely destroyed, or great deformity is produced. It must not however be forgotten, that in long continued unnatural position of a part, consequent on a scar formed in one of these ways, secondary contraction of the muscles, and alterations in the joints may be produced, by which the movements are still further restricted; and this condition may even become incurable.

1553. All the outlets are peculiarly constituted. They are either furnished with a true muscular apparatus, or at least are endowed with a special contractility, upon which their alternate expansion and contraction depend. Their inner surface is always overspread with mucous membrane, in consequence of which they can, exclusive of the cases from compression by neighbouring swellings and the like, be narrowed or closed in a variety of ways: thus, *first*, by spasmodic contraction, sometimes transient, sometimes continued; *second*, by hypertrophy, thickening and swelling of the parenchyma of the mucous tissue lining the outlet, consequent on previous inflammation, and on an unnatural vegetative process: *third*, by actual growing together, when for instance the mucous membrane of the outlet is destroyed; and, *fourth*, by scars which form at the edge of the outlet, or in its neighbourhood.

1554. The congenital closure of outlets, (*Atresia*, *Imperforatio*,) as well as the congenital union of parts, which should be separate from each other, (*Synechia*,) are arrested formations, in which the fœtus, at an early stage of its development, remains stationary, when the openings and clefts on the outer surface of the body do not yet exist, and parts which at a later period become separate, are still united together. The skin originally overspreads the whole surface of the body, and has on the parts where it closes the openings and clefts, the same character as elsewhere; it thins gradually, appears then as a peculiar secreting membrane, and is lastly removed by the process of absorption. As the *Atresiæ* are in the earlier stages of development of the fœtus, natural formations, so also are the *Synechiæ;* for instance, union of the eyelids with each other and with the eyeball; the union of the tongue, of the *glans penis* with the prepuce, and the like.

1555. If the closure of the outlets be a vicious primary formation, either the organization of the outlet is natural, and its opening only closed by a mere skin, though sometimes by a tough fleshy mass, or no trace of an outlet can be perceived externally. When the congenital closure of an outlet by which matters pass exists, it shows itself soon after birth, as in closure of the *anus*, *urethra*, and the like; but if it occur in those which only at a later period assume the peculiar condition of outlets, as, for example, the *vagina*, the closure is generally then first observable.

1556. The *treatment* of union of parts, which in the natural state are free and movable, requires division with the knife, together with the prevention of reunion, and all contact of the divided parts, by careful insertion of folds of linen, or lint besmeared with mild, and afterwards with drying ointments. The parts must also at the same time be kept in proper position, and during the period of granulation prevented by due application of caustic, from coming to that state in which they can again unite from the *angle* of the division; for which purpose, usually, pressure properly employed, is most efficient.

1557. In shapeless scars, which, by contracting parts, interfere with their position and movement, only in rare cases can any considerable relaxation be effected by the continued use of softening ointments, baths and the like; usually, by operation alone can improvement or perfect cure be effected; the management of which is different according to the condition and seat of the scar. If the scar be cord-like, tense, and by its shortness destroy motion, several transverse cuts may be made through its whole mass, and afterwards an apparatus put on, by which the parts shall be retained in natural posture, so that the formation of a *broad* scar may be effected. When the scar is broad, or united with the underlying parts, so however that its release is possible without injury to important parts, it must be cut out. The scar must be included between two cuts, and separated by careful dissection from the parts beneath, or the cellular membrane. If the skin in the neighbourhood of the wound be yielding, the edges of the wound, if it be not of very great extent, must be set free so far, that they may be united with the interrupted, or with the twisted suture. Although the edges of the wound be thus much stretched, and the skin also in the subsequent healing be still so, yet in a short time it yields, and all deformity disappears. When, as is commonly the case, this union is impossible, the wound must be treated as one suppurating, and retained by a proper apparatus in its straight posture. For the purpose of making the scar sufficiently broad, frequent touching with lunar caustic must be resorted to. I have, however, always found that, in consequence, correspondent condition of the scar is produced, that is, the tough, knotty projection can be prevented; but the special contraction of the edges of the skin towards the centre is encouraged. In all cases, therefore, in which I wish to form a broad scar, I only cover the suppurating parts with softening poultices or washes, and but rarely use caustic. When the scarring goes on tediously, there is always least disposition to contract, and the easier is it to produce a broad scar. If the scar project in knots and thereby be disfiguring, it must either be removed with the knife held flat, from its base, and the wound healed up in the usual way; or it must be cut completely out, and treated according to circumstances, after the above-mentioned rules.

On the different modes of treating deformed scars, compare

Beck; in Heidelb. klinisch. Annalen, vol. v. p. 213.

Dupuytren; in his Leçons Orales de Clinique Chirurg., vol. ii. p. 1.

1558. The narrowing and closure of the outlets require, according to their several causes, a different treatment. In spasmodic contraction, both local and general, corresponding antispasmodic remedies must be employed. If the narrowing result from an organic change of the mucous membrane, it must be specially ascertained whether, and what is the cause of the inflammation, which must be met with corresponding treatment. Should this, however, not be sufficient to get rid of the narrowing, the employment of mechanical means, which gradually widen the outlet, is required; or the removal of the hardened part of the mucous membrane must be attempted with the knife, with caustic, and the like. In these various modes of treatment, it must always be remembered, that should the natural calibre of the outlet be restored, the mucous membrane has always a peculiar disposition to reproduce the narrowing.

1559. The cure of imperforation is more or less difficult, in proportion as the seat of the closure is more or less deep, and depends on a membrane, or a fleshy mass. The closed part must be cut into, and its reunion prevented by the introduction of mechanical bodies. In closure of an outlet by membrane, if the latter be thrust down, in a flask-like form, by the collection of the excreted matters, the division is easy, and the skin must be divided with a crucial cut. But if the union be intimate and fleshy, the division is more difficult, and so much more so, in proportion to the greatness of its extent; it must always be made in the middle line of the union. If there be scarce any trace of the external opening of the outlet, the cut must be made in the direction in which it should open, and the outlet there sought for.

SECOND SECTION.—OF UNNATURAL COHERENCE IN PARTICULAR.

I.—OF THE UNION OF THE FINGERS AND OF THE TOES.

EARLE, HENRY, On Contractions after Burns or extensive Ulcerations; in Med.-Chir. Trans., vol. v.

—— Further Observations on Contractions succeeding to Ulceration of the Skin, in Med.-Chir. Trans., vol. vii.

BECK, K. J., Ueber die angeborne Verwachsung der Finger. Freiburg, 1819. 8vo.

SEERIG, Ueber die angeborne Verwachsung der Finger und Zehen, und Ueberzahl derselben. Breslau. 4to; with two lithographed plates.

1560. The union of the fingers with each other has different degrees of intensity and extent, and is either congenital or accidental, especially after burning the fingers. The congenital union arises, *first*, from bridges of skin; *second*, from connexions of skin and flesh; and, *third*, from running together of bone. The first kind of union is the most frequent. The natural formation of the finger may also be variously degenerated in these unions.

1561. The single mode of getting rid of these deformities consists, in dividing the union, which is alone contra-indicated, when the soft parts of the hand are grown together in an unshapely mass (1), and the bones of the fingers so run together, that there is scarcely any connexion by joints. Diseased condition of the skinny covering of the ill-formed hand, a highly scrofulous condition of the constitution, still existing inflammation, or great plastic activity, and the age of the party, may render the delay of an operation requisite. The time generally considered most suitable for operation, is the end of the first year of the child's life, and beyond that time, except for very special reasons, it should not be deferred. The fact, however, that even after the operation-wound has been perfectly healed, the fingers will again grow together, which depends partly on the deficiency of the skin, and its production not corresponding with the formation and growth of the finger, partly on the incompletely divided union stretching on with the enlargement of the finger, is of the greatest importance, and must, if the union of growth do not prevent, seem most properly to put off the operation, till the complete development of the finger (*a*.) The painfulness of the operation, as well as the ensuing inflammatory reaction, depend on the degree and extent of the union, on which account only one hand should be operated on at once, and the other at a more distant time.

(1) In a case in which the hands of a child presented only two lumps of flesh with a single undivided nail, five movable fingers were made, by cutting through the common cartilaginous mass (*b*).

1562. The result of the operation is often unsatisfactory, as reunion of the divided parts will occur, under the most careful treatment. This is to be especially feared at that period when the granulations rise from the hinder angle of the wound, and the edges of the wound draw together from both sides. To prevent this, various modes of operation have been proposed.

1563. In a simple, merely skinny union, after properly fixing the hand,

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(*a*) SEERIG, above cited.

(*b*) LEROUX; Journal de Méd., vol. xiv. p. 275, p. 645.

a pointed bistoury is thrust, either with its edge towards the operator, somewhat above the angle of the natural junction of the fingers, vertically, through the connecting skin, and then divides it in the mesial line to the finger-tips; or the knife is carried from the points of the fingers backwards through the connexion. The irregularities of the edges of the wound are to be trimmed with the scissors. If the bones be also connected, the soft parts must be first divided with the bistoury, and afterwards the bony union, through the mesial line, with a little watch-spring saw. The dressings must be most carefully applied: a strip of linen, spread, at its ends only, with adhesive plaster, must be placed in the angle of the wound, and the two ends respectively fixed on the front and back of the hand. Over this a small long pad is placed, the surface of the wound covered with some folds of linen, spread with ointment, each several finger enveloped in a bandage, and the finger, by means of a piece of card-board or wood attached to the hand, kept as straight as possible; this may also be effected by particular contrivances (*a*). The dressing should be daily and very cautiously renewed once or under particular circumstances even twice, with strips of linen laid close in the angle of the wound; and towards the end of the cure, by a moderate application of caustic, the growth of the granulations there must be repressed.

DUPUYTREN (*b*) applied a narrow long pad with its middle on the angle of the wound, carried its ends to the fore-arm, and fastened them to an arm-bandage. He could not, however, by these means prevent the reunion. And he did not succeed any better with a narrow strap which he buckled to the arm-bandage.

1564. To prevent the reunion of the angle of the wound, which especially in firm union, is to be dreaded, RUDTORFFER (*c*) thrusts a steel needle fourteen lines in length, the point of which is lancet-shaped, and its other end having a hole, for the reception of a leaden thread two inches long, vertically between the two united fingers, and thus introducing the leaden thread, bends and leaves it there. Cold water checks the bleeding and pain, and the sticking of the leaden thread is diminished by smearing the edges of the wound with oil. The thread is to be frequently moved, and the drying up and scarring hastened by use of lead wash. BECK (*d*) uses a lancet-needle ten lines broad with a leaden thread of equal width, which is left for some time, till the scarring of the edges of the wound. The leaden thread has a decided preference to the leaden plate, as by fixing its turned ends, pressure is always kept up against the angle of the wound, for with the leaden plate, with which this cannot be done, the growth at the angle of the wound goes on, and the lead is thrust out, as I saw in one instance.

1565. If the skin upon the back of the united fingers be sound and natural, it should be divided, according to ZELLER (*e*), a little beyond the second phalanx; a V-shaped cut should then be made in the skin on the dorsal surface, with its point on the middle of the connecting substance. The skin should be detached, turned back, and, after the complete division of the union, this flap should be carried down between the fingers towards the palm, and fixed with sticking plaster. This treatment

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(*a*) ZANG; Darstellung, u. s. w., vol. iv. pl. iii.

(*b*) Leçons Orales, vol. ii. p. 36.

(*c*) Abhandlung über die einfachste und sicherste Operationsmethode ein gesperrter! Leisten- und Schenkelbrüche; nebst einem Anhange merkwürdiger, auf den operativen Theil der Wundarzneikunst sich bezienden Beobachtungen, vol. ii. p. 478.

(*d*) Above cited.

(*e*) Abhandlung über die ersten Erscheinungen venerischer Local-krankheitsformen, p. 109. Wien, 1810.

is rarely possible, as the skin is most commonly hard, callous, morbidly changed, and the flap commonly dies (*a*). Krimer (*b*) has, however, given some satisfactory reports of this operation.

1566. If the reunion of the fingers cannot be prevented, the operation must be repeated, but the inflammatory reaction and plastic activity must have completely subsided.

II.—OF GROWING TOGETHER OF THE JOINT ENDS OF BONES, OR ANCHYLOSIS (*c*).

Müller, Diss. de Anchylosi. Lugd. Batav., 1707.

Van Doeveren, Diss. de Anchylosi. Lugd. Batav., 1783.

Murray, Diss. de Anchylosi. Upsal, 1787.

Delpech, Précis Elémentaire, vol. i.

Barton, On the Treatment of Anchylosis, etc. Philadelphia, 1827.

Lacroix, De l'Anchylose; in Annales de l'Anatomie et de la Physiologie pathologiques, publ. par Pigné, 1843.

1567. Every intimate union of two bones, which naturally are connected together in a joint, produces complete loss of motion in the joint (*Anchylosis*, Lat.; *Gelenksteifigheit*, Germ.; *Ankylose*, Fr.)

Anchylosis is commonly divided into *true* and *false*. Under the former, is comprehended the loss of motion in a joint, depending on the union of the joint-surfaces; under the latter, that condition, in which the movements of the joint are only more or less interfered with, as is observed in long-continued inflammation of joints, in swellings of the ligaments, in tumours near the joints, in continued contraction of the muscles, and the like. This division is, to a certain extent, incorrect and objectionable, because, in the so-called false anchylosis, the hindrance of motion is only to be considered as a symptom of the disease, towards the removal of which the plan of treatment must be directed, and the union of the joint-ends of the bones is alone to be considered as the actual disease.

1568. The growing together of the joint-surfaces may be produced in various ways. It is usually consequent on inflammation of the parts composing the joint, especially when of some standing, and when the joint has been long at rest. If the inflammation go on to suppuration, and the cartilaginous surfaces be destroyed, if there be carious destruction of the bones, granulations may form, which, by shooting into each other, may become the means of union. Long-continued immobility of a joint may also cause an union of the surfaces. Although this is very rare, and may be readily distinguished, from the restrained motion which is consequent on habitual contraction of the muscles, on swelling of the ligaments and the like, observed after dislocation, and after the treatment of fractures, and may be got rid of by motion, softening rubbings, and so on, it is, however indisputable; although the ordinary explanation given of it, from want of *synovia*, or comparison of it with the obliteration of blood vessels, when the circulation is suppressed, is insufficient (*d*).

1569. According to the sort of union of the joint-surfaces produced, and its duration, is the nature of the connecting substance. It is either soft and yielding, frequently lengthening into ligament-like bands, or it is converted into an actual bony mass by the deposition of phosphate of lime.

(*a*) Walther, Ph. F., Ueber die angebornen Fetthautgeschwülste, p. 32. Landschut, 1814. fol.

(*b*) Graefe und Walther's Journal, vol. xiii. p. 602.

(*c*) All the additions which seemed to me necessary, have been already made at p. 240, vol. i., in treating of Anchylosis as a termination of joint disease.—J. F. S.

(*d*) Delpech; above cited, p. 611.

1570. The *treatment* of anchylosis must be determined by the following circumstances. In most cases where anchylosis takes place, it is a desirable result, for example, in *caries* of joints, the so-called white swelling, and the like; and it should by no means be sought to prevent it, for all the attempts made with that object will only increase the inflammation, and the danger of the anchylosis. In such cases, therefore, the joint must be kept in the most perfect rest, and in such position, that the anchylosis ensuing will be most convenient and advantageous. Subsequently, when the inflammatory symptoms have disappeared, three conditions are possible: the substance connecting the joint-surfaces is either yielding, and by continued and gradually increased movements of the joint, may be lengthened into ligament-like bands, or these motions may reproduce the inflammatory symptoms, or they may be very difficult, and become every day more and more confined. In the first case, the movements are always accompanied with pain, which must be got rid of by emollient and soothing applications, rubbings in, bathing, and the like, and motion not carried to such extent as would produce fresh inflammation of the joint. In the second case, all motion must be avoided; and in the third, no effort can be in the least useful, because the mass has been already more or less converted into bone.

J. Rea Barton (*a*) sawed through the thigh-bone at the *trochanter*, in a case of anchylosis at the hip-joint, brought the limb into proper position, and by motion prevented union. He also employs this practice on other joints. It is only practicable when the patient is in good health, and when the stiffness depends on the soldering together of the bones, the soft parts at the same time being unaffected with disease, and all the muscles and tendons which contribute to the motions of the joint healthy; when the cause of the disease is entirely removed; when the operation can be performed so close to the original point of motion, or so near to it that the functions of the greater number of muscles and tendons can be preserved; and when the deformity and inconvenience is so great, that the patient is induced to subject himself to the pain and danger of such an operation. von Wattmann has obtained a favourable result by sawing through the upper-arm bone in anchylosis of the elbow joint. Dieffenbach (*b*) believes that the separation of the united joint by means of the chisel and saw, would not be more hurtful than the above-mentioned sawing through of the bone, to form an artificial joint, inasmuch as the anchylosed joint is no longer a joint, and therefore wounding it is not to be so much dreaded.

1571. The slighter degrees of the so-called false anchylosis, depending on contraction of the muscles or ligaments, or on contracting scars, may be completely removed by rubbing in suppling ointments, by relaxing baths, steam, and the like, with the simultaneous use of apparatus (1), which gradually straighten the joint. In the more severe forms of contraction little or nothing is effected in this way; in such cases, *violent and sudden extension; gradual extension with an apparatus, the tendons having been previously divided;* or, *sudden and violent extension soon after cutting through the tendons*, have been proposed and practised. The first mode of treatment (Louvrier's) is objectionable (2); the extension, by apparatus, after division of the tendons is generally tedious, must be very long continued, often produces considerable pain, and frequently meets with invincible obstacles; with it, however, no dangerous symptoms are to be feared. The violent extension after division of the tendons will considerably shorten the cure (Dieffenbach). This mode of treatment

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(*a*) On the Treatment of Anchylosis by the Formation of Artificial Joints; in North American Med. and Surg. Journal, vol. iii. p. 279. 1827.

(*b*) Ueber die Durchschneidung der Sehnen und Muskeln, p. 249.

especially applies to the false anchylosis of the knee; it may, however, be employed in other joints.

(1) Of the various apparatus for extending the knee-joint (STROMEYER, DUVAL, BOUVIER, and others) I think STRETTER's the most preferable.

(2) According to BERARD, (*a*) of twenty-two cases of false anchylosis, treated by LOUVRIER's method, three were fatal, on account of the severity of the violence; in neither was a well-formed joint produced; in the greater number there was dislocation of the knee backwards, and always renewed though slight contraction.

1572. In contractions of the knee-joint the patient is laid on his belly, that the crooked knee may project beyond the edge of the table. The tendons, having been rendered very tort by violently pulling the leg, are cut through beneath the skin, and the limb bent so strongly that the heel shall touch the buttock. It is then again forcibly extended, and again flexed, and this backward and forward motion is continued till the limb is straightened. Sometimes there is a loud crack, from the false connexions being thus torn through. In grown persons it often requires the united strength of three or four men, to break the knee-joint perfectly straight. Even in a case of true anchylosis, consequent on a penetrating wound of the joint, and its resulting suppuration, the breaking through of the united knee-joint, and the straightening of the limb, is required (DIEFFENBACH.) Immediately after the extension of the limb is effected, the knee-joint should be covered with pads, enveloped in a flannel roller, laid upon a padded hollow splint, and the splint and limb fastened together with a second flannel bandage. On reapplying the apparatus, the limb must be carefully cleansed, and in replacing it, much local pressure must be avoided, or slough of the skin will quickly ensue. After completion of the cure, the straight stiff joint must be carefully bathed and rubbed with suet. In many instances, if the joint again become flexible, the patient may be able to walk without halting (DIEFFENBACH.)

1573. Very severe symptoms may result from this violent extension of the limb, great inflammation, with its consequences may ensue, so as to render amputation necessary, and may even cause death. These emergencies, as well as the more or less favourable result of the operation rests, independent of the constitution of the patient, especially on the changes which have occurred in the joint itself and in the neighbouring parts. In contractions already long existing, and accompanied with great alteration of the joint, there is always a dislocation of the leg upon the thigh, from within outwards, or from without inwards; the shin-bone often gets under the thigh-bone, so that the foot is shortened, the knee-cap very prominent, and the ham less hollow; the condyle of the thigh-bone is often curved backwards, the whole limb wasted and atrophic. In such cases little violence is needed to dislocate the leg backwards. Even when by such alteration of the joint, the straight posture is effected, it has a most imperfect result, as the joint always remains more or less bent, the leg more or less placed behind the thigh, and the patient is only able to go on a crutch. In long-continued contraction of the knee-joint, the popliteal artery may be so considerably shortened, that extension of the limb cannot be effected without tearing it. (CHASSAIGNAC.) The splint-bone may be also so fast connected with one or other condyle of the thigh, or may be so thrust in between the shin- and thigh-bone, as to render the straightening of the limb impossible. If the contraction of the joint be only consequent on a

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(*a*) Gazette Médicale de Paris, vol. ix. p. 324. Paris, 1841.

change of the surrounding parts, the result of the operation will be more favourable, as the joint will resume its natural form, power, and motion. In this case the joint is always more movable in the flexing direction. Great crookedness of 'the knee-joint often cannot be rendered straight after cutting the tendons; it will always crook again. The cause is, in this case, in the shortness of the lateral ligaments, usually in the external one, which is stretched under the skin, and must be cut through beneath it (*a*).

III.—OF THE GROWING TOGETHER AND NARROWING OF THE NOSTRILS.

1574. A complete closing up of the nostrils is more rare than their narrowing, and is commonly the result of ulceration and burns; it is rarely congenital. In slight narrowing, the malformation is inconsiderable, and usually requires no assistance. In more considerable narrowing, or growing together, the breathing is affected, especially at night, and the speech also. The connexion may be either at the edges of the nostrils, or the wings of the nose may adhere to its *septum*, and the growing together may extend more or less into its cavities. By the projection of the air in blowing through the nose, with the nostrils still open, the extent of the connexion may perhaps be ascertained.

1575. When the nostrils are merely narrowed, after an assistant has fixed the patient's head, a director is to be introduced into the nostril, and upon it a narrow straight bistoury, with which the narrowed part is to be cut through according to the form and direction of the nostril, which is thus widened. If the nostril be closed by a mere skin, this must be pierced with a bistoury, and its edges, having been taken hold of with forceps, raised and cut off. If the nostril be completely grown together, the bistoury must be thrust in the direction where the cavity should be, till it reach it, and being then withdrawn, and a director introduced, the bistoury is to be carried in upon it, and the connexion divided, as above described. This operation is always more doubtful, and its consequences less certain, the higher the connexion extends.

1576. After the division, the natural calibre of the nostril must be preserved by dressing, which is managed by introducing plugs of lint, or a quill wrapped with lint, by gum-elastic tubes, or Benjamin Bell's little tubes (*b*) smeared with lead ointment, and kept in position by a bandage round the head. The dressing must be renewed daily, all foreign matters removed, the nose cleaned, and after injection of lead wash, reapplied. If the introduced hard substances produce much irritation, plugs of lint must be used instead. This treatment must be continued till the opening of the nostril be completely skinned over, and even still longer, if we desire to avoid all disposition to a recurrence of the growing together or narrowing. When such disposition is noticed, it must be opposed by the use of expanders, sponge-tent, and the like.

On account of the great disposition to repeated closure, the operation must never be undertaken whilst the plasticity is still very active. When the narrowing of the nostril depends on unnatural formation of the bones, no expansion can be effected.

(*a*) Phillips, Ch., De la Tenotomie souscutanee, &c., p. 114. Paris, 1841. 8vo.
(*b*) System of Surgery, vol. iv. p. 88. 1786.

IV. OF UNNATURAL ADHERENCE OF THE TONGUE.

Petit; in Mémoires de l'Académie des Sciences. 1742.

Louis, Sur les Tumeurs Sublinguales; in Mém. de l'Acad. de Chir., vol. v. p. 410.

Oehme, De Morbis recens-natorum chirurgicis. Lipsiæ, 1773.

Lang, De Frenulo linguæ, ejusque incisione. Jenæ, 1785.

1577. An unnatural adherence of the tongue, by which sucking, the movements of the tongue, and proper articulation of the voice, are more or less prevented, may depend, *first*, on a tough, fleshy swelling of a brownish colour, and often nearly of the same size with the tongue, beneath which it lies; *second*, on the tongue-string (*frænulum*,) which either extends to the tip of the tongue, or is too short, (*tongue-tied* of common language, J. F. S.); *third*, on membranous connexions of the tongue on one or both sides; *fourth*, on union of the under surface of the tongue with the corresponding surface of the mouth.

The *diagnosis* of these conditions rests on examination. In children, by holding the nose, the mouth is made to open, and then with two fingers the tongue is raised and pressed towards the palate and sides. The examination is more necessary, as in many cases, the inability of children to suck from their mother and wet-nurse is ascribed to the tying of the tongue, whilst it really depends on other causes.

1578. When by this unnatural attachment of the tongue, sucking is prevented, or at a later period the speech is interfered with, the tongue must be set loose that it may enjoy free motion.

1579. In cases where the above-mentioned tumour is observed under the tongue, speedy assistance is always needed, which consists in cutting into the swelling. An assistant holds the child's nose, forcibly lifts up the tongue with the thumb and forefinger of the left hand, with its palm upwards, by which the fleshy mass is made more tense, and then it is cut into with a pair of blunt-pointed scissors. The wound generally heals in a few days, the spittle and milk render any topical application useless, and it is necessary to move the finger under the tongue frequently during the day, in order to prevent the reunion. In some cases it is advisable to scarify the tumour with a lancet, to diminish its size and give the tongue free motion. If the ranine artery or vein be wounded, it must be treated as already mentioned.

1580. The division of the tongue-string either when too short, or when reaching the tip of the organ, must be effected after properly raising the tongue, as in the former case, with the two fingers of the left hand, or with a spatula having a cleft in it for receiving the tongue-string, and rendering it tense, by Schmitt's tongue-scissors, which, with their convexity upwards, are carried to the *frænulum* and cut through it, at a stroke, to the necessary extent. In doing this the scissors are directed as low as possible, towards the bottom of the mouth, to avoid injuring the ranine artery.

The instruments referred to are Petit's spatula, with a snap-knife (*a*). Benj. Bell's scissors (*b*). Schmitt's scissors (*c*).

1581. When the tongue unites with the corresponding surface of the mouth, the child's mouth must be kept open by means of a piece of cork thrust between the jaws, and the tip of the tongue being raised with the

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(*a*) Above cited, fig. 1, 5, 6, 7.

(*b*) Above cited, vol, iii. pl. xiii. f. 166.

(*c*) Loder's Journal, vol. iv. part ii. pl. v. f. 1, 2.

fore and middle fingers of the left hand, the tongue must be set free with a curved bistoury to its proper extent.

[Occasionally, though not, I believe, very often, after severe sloughing of the membrane of the mouth, mostly after the use of mercury, the tongue contracts adhesion with the cheek. I have recently had one such case under my care, the only one I have seen, in which the side of the tongue was attached to the extent of half an inch. I applied a ligature around the band, which separated in three or four days, and set the tongue free. I preferred the ligature to snipping it through, lest there might be trouble from after-bleeding.—J. F. S.]

1582. The accidents which may occur after separating the tongue in the above cases are bleeding, and when the tongue has been divided to a great extent there is danger of suffocation. Attempts to stop bleeding of the wounded ranine artery must be made with little bundles of lint, moistened in styptics, THEDEN's arquebusade, or a solution of alum, which should be pressed against it with the finger; or the actual cautery may be applied to the bleeding part, which in all cases is preferable to the compressors of PETIT, JOURDAIN, and LAMPE. Bleeding may also be produced by the child sucking his tongue; in which case the blood will be swallowed. Care must, therefore, be taken for the first few days, that when he awake he be laid on his breast.

If there be danger of suffocation by the tongue turning backwards, it must be brought forward with the finger in the mouth, put in its place, and there kept by means of a thick pad put upon the tongue, and fastened by a bandage carried round the lower jaw; this must be removed as often as the child needs to drink (*a*).

1583. The membranous connexion of the tongue with the corresponding part of the gums, fixes the tongue either equally on both sides, or it is drawn to one or other side, according as it is unequally attached, or upon one side. The division of this connexion is always easily effected with the scissors.

V.—OF GROWING TOGETHER OF THE GUMS AND CHEEKS.

1584. The growing together of the gums with the cheeks is mostly consequent on inflammation and excoriation, the violent use of mercury, and the severe salivation following it, if the lips and cheeks be quiet. It may be of greater or less extent, by which chewing and speech are more or less hindered. It may be prevented in the above instances by frequently cleansing and injecting the mouth, by pencilling it with mucilaginous fluids, by the introduction of pieces of soft linen, by frequent movements of the parts, and introduction of the fingers; and, by the same means, an already formed agglutination may be got rid of. If the connexion be firmer it must be divided with a bistoury, and prevented reuniting.

VI.—OF NARROWING AND CLOSURE OF THE MOUTH.

DIEFFENBACH, Erfahrungen über die Wiederherstellung zerstörter Theile, u. s. w., sect. iii. p. 65.

ROST, G., Diss. de chilo- et stomatoplastice. Berol., 1836.

BAUMGARTEN, Diss. de chiloplastice et stomatopoesi. Lips., 1837.

ZEIS, Handbuch der plastichen Chirurgie, p. 435.

1585. Complete closure of the mouth as a vice of the first formation, is very rare, and mostly accompanied with other vicious formations. A

(*a*) PETIT.

small opening must be first made in one or other corner of the mouth, whilst lifted up with the forceps; a director is then introduced, and upon it the closed membrane must be divided.

1586. Narrowing of the mouth frequently happens in consequence of large scars after the operation for cancer of the lip, or after any other wound with great loss of substance; usually, however, the mouth expands and the lips and cheeks retaining their extensibility, gradually allow its return to the ordinary form. But when there is a hard callous state of scar with simultaneous great loss of substance, and growing together of the membrane of the lips and cheeks with the gums, as after burns, destroying ulcers in *herpes rodens*, but especially after excessive and ill-employed use of mercury and the like, then such enlargement of the mouth will not follow, and three degrees of deformity may be distinguished; *first*, narrowing of the mouth from growing together of the internal surface of the cheeks and lips with the jaws, in which the external lips are unconcerned; *second*, the growing together of the mouth, and the conversion of the cleft of the mouth into a small round hole; *third*, destruction of the external lips with great loss of substance to a wide extent, so that the teeth are exposed, and the jaws cannot be separated from each other (DIEFFENBACH.) The inconvenience is various, according to the degree of narrowing; the introduction of food and chewing, is more or less difficult; the patient often can take only liquids with trouble; the nourishment fails, tartar collects on the teeth; the smell of the breath is very offensive, and the like.

1587. Widening of the mouth by cutting at both corners, as formerly advised, is useless, as the cut always again unites, and the deformity is worse. The treatment must vary according to the several degrees of narrowing and destruction of the lips.

1588. If the lips, otherwise unhurt, be connected by thread-like adhesions to the jaw, that part of the lip where the union is greatest, must be strongly drawn down, the tough scar divided, and the adhesions throughout their whole extent properly removed with the knife or scissors, as far as possible, to allow the lower jaw to be depressed. The mouth is then to be well washed with cold water, and frequently widely opened, and the cure usually soon follows. But if the entire surfaces be grown together, a corresponding portion of the sound membrane of the mouth must be separated to the thickness of common paste-board, applied over that part of the cheek opposite the meeting of the teeth, and fastened with the interrupted suture, so as to prevent the reunion of the wounded surface by the mucous membrane spread over it. When in these cases the breadth of the lips is narrowed by previous ulceration and proportionally shrivelled, no advantage will be derived by this operation, as they will always remain attached to the jaws. The enlargement of the aperture of the mouth must also be effected in the way above mentioned.

1589. In considerable narrowing of the mouth from its growing together and firm scarring, which mostly affects one or other corner of the mouth, or even both, DIEFFENBACH's (*a*) and WERNECK's (*b*) modes

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(*a*) RUST's Magazin, vol xxv. p. 383, and work above cited, p. 44.

(*b*) Ueber die künstliche Mundwinkel- und Lippenbildung durch blutige Umschlagung der Mundhaut; in VON GRAEFE und WALTHER's Journal, vol. iv. p. 202. His mode of treatment is similar to DIEFFENBACH's, but published subsequently.

of treatment are the best. A thick strip of the entire soft parts, down to the mucous membrane, which must be left uninjured, is to be cut from the mouth at one or both sides; for which purpose, the pointed blade of a pair of sharp scissors thrust into the corner of the mouth is carried to some extent between the soft parts of the cheek and the mucous membrane, and the cheek cut through to the part where the angle of the mouth is to be formed. From the lower corner of the mouth, a cut parallel to the former is connected by a short circular cut. The piece of skin thus circumscribed, is now to be completely separated from the mucous membrane, and afterwards the other side similarly treated. When the bleeding is stanched, the lower jaw must be much depressed, by which the exposed mucous membrane will be considerably stretched, and must then be separated for a few lines from the membrane of the cheek, and divided in the middle, but not so far as the corner of the mouth. After stanching the blood and closing the wound, the mucous membrane must be drawn out over its edges, and the edges of the membrane connected around with fine needles and the twisted suture. The mucous membrane folds opposite the middle of the lip which has not been disturbed. The part of the mucous membrane not cut through should be well drawn out at the corners.

The bloodless expansion of the mouth with sponge-tent, and the like, is useless. Horizontal cuts on either side, as formerly recommended for widening the mouth, are unavailing, inasmuch as they always re-unite, and the person's condition is worse. The practice of Krüger-Hansen (*a*), who, after Rudtorffer's statement in reference to united fingers, (*par.* 1555,) made an opening with a trocar into a mouth half closed by a callous scar, at the point where its boundary was to be fixed, in which he allowed a leaden thread to remain till the part had skinned over, after which the remaining cut was made, is tedious, uncertain, and produces a callous aperture for the mouth.

1590. If with narrowing of the mouth there be such loss of substance in the lips, that the teeth are exposed, and the jaws cannot be separated from each other, and in which often the small opening of the mouth is dragged upon the cheek, the deformity can be only somewhat improved, and the patient's condition alleviated, after careful examination of the peculiarity of the case, by cutting out the hard scar, loosening the attachment to the jaws, drawing over the skin, and the like.

Compare also an interesting case of a similar operation of Dieffenbach's (*b*).

VII.—OF NARROWING OF THE ŒSOPHAGUS.

Bleuland, Observationes anatomico-medicæ de sana et morbosa Œsophagi structura. Lugd. Batav., 1769.

Von Geuns, M., in Verhandelingen uytgegeeven door Holl. Maatschappy der Wetenschappen, vol. xi. Haarlem, 1769.

Kunze, A. G., Commentatio pathologica de Dysphagiâ. Lips., 1820.

Home, Everard, Practical Observations on the Treatment of Strictures in the Uretha and Œsophagus, vol. i. p. 536. London, 1805; Third Edition, vol. i. p. 395; Second Edition, London, 1821.

Fletcher, Robert, Medico-Chirurgical Notes and Illustrations on some dangerous affections of the Throat; on Strictures of the Œsophagus, &c. London, 1831. 4to.

Mondiere; in Archives générales de Médecine, vol. xxv. p. 58. 1831.

Appia, Dissert. de Stricturis Œsophagi. Heidelbergæ, 1842.

Chelius, Ueber die Behandlung der Stricturen des Œsophagus; in Heidelberg. Medic. Annal., vol. i. pt. ii.

(*a*) von Graefe und Walther's Journal, vol. iv. p. 543.

(*b*) Erfahrungen, sect. iii. p. 110.

1591. Narrowing of the *œsophagus* may be produced by various causes; by scars after wounds or burns (*par.* 474); by the swelling up of its walls consequent on chronic inflammation of its internal coat; by scirrhous or callous hardening; by fungous, polypous, or warty growths; by a varicose condition of the vessels; by tumours, especially swellings of the glands which compress the *œsophagus;* and by spasm.

HOEDERER (*a*) observed an *œsophagus* with a blind end in a monster. The same was also seen in a full-grown and otherwise well-formed child (*b*).

1592. The consequence of narrowing of the *œsophagus* is more or less interfence with swallowing; the symptoms, however, vary according to the kind and seat of the narrowing.

1593. In *simple* (*membranous*) *stricture*, which, resembling a fold of the internal membrane of the *œsophagus*, occupies only a small extent, and is usually situated at the upper part of the tube, opposite the cricoid cartilage, the patient first feels, at one particular spot, a slight difficulty in swallowing solid food, and, when the food passes over the part, often a shivering in the back. This difficulty continues a longer or shorter time, diminishes or ceases, and reappears without any particular cause, or after a chilliness, mental emotion, and the like. The disease may thus long continue getting better and worse. Earlier or later, the difficulty in swallowing becomes greater, large pieces of food will be retained at that particular part of the *œsophagus*, in consequence of which, symptoms of choking, with the sensation of a violent, spasmodic contraction of the neck, cough, and great straining are produced, by which the food, frequently with an audible grating noise, passes over the obstacle, or by the contraction of the walls of the *œsophagus*, and the straining of the patient, is returned to the mouth, and thrown out. The difficulty in swallowing is now constant, and increases more slowly or quickly, so that the patient can swallow less and less food, with the above-mentioned symptoms; at last can swallow it no longer, and is reduced to the use of thin broths and fluids, in the swallowing of which even, the same symptoms come on. Even when the difficulty in swallowing is constant, there is often, from time to time, a little improvement, for which, however, as well as for the subsequent aggravation, no reason can be assigned, if accompanying spasmodic affection be not assumed. With the increased difficulty of swallowing, the patient's nourishment is affected; he wastes to the most extreme degree, and is starved to death. In this form of stricture of the *œsophagus*, there is, however, no further appearance of any specific morbid reaction.

1594. The change by which the internal membrane of the *œsophagus* causes this narrowing, in which it forms a fold-like projection, capable of contracting itself to the smallest aperture, generally depends on an inflammatory condition of the mucous membrane of the *œsophagus;* frequently, however, no decided cause can be found; oftentimes it occurs after a cold. At the beginning, the disease, on account of its getting alternately better and worse, is thought to be a spasmodic affection; it is, however, probable that a spasmodic affection may pass into permanent stricture. This form of narrowing of the *œsophagus* occurs more frequently in mid-life, and, according to my experience, more frequently in women than in men; I have, however, noticed it in persons of fifty or sixty years of age.

HOME (*c*) has given a beautiful engraving of a membranous stricture.

(*a*) Commentar. Societ. Goetting., vol. iv.

(*b*) HARLESS, Rheinisch. Jahrbüchern der Med. und Chir., vol. i. pt. 2.

(*c*) Above cited, p. 422.

1595. The *callous narrowing* of the *œsophagus* mostly consists of a circular thickening of the walls of the tube, at a particular spot; it may, however, be variously spread, often only one or other wall of the *œsophagus* is affected to a different extent. It is generally, from the first, accompanied with great inconvenience; the food, at the moment of swallowing, causes violent pain, mostly between the shoulder-blades; it is thrown up, and commonly also with it a morbidly large quantity of tough mucus, secreted from the almost entirely closed breathing passages. The patient assists himself by throwing himself back, stretching out his neck, and similar movements, in order to carry the food over the seat of narrowing; oftentimes the food passes on with a noise and cessation of pain; afterwards every portion of food is returned, with a gurgling noise and violent cough. This disease also for a time yields, and usually makes slow progress; I have, however, seen in one case the patient starved to death in three months, and on examination a circular, regularly callous thickening of the walls of the *œsophagus* was found at its upper part, and gradually lost itself both above and below.

1596. In *scirrhous hardening* of the walls of the *œsophagus*, which otherwise in its symptoms has great resemblance to the callous condition, and is generally situated at the lower part of the *œsophagus*, and even at the *cardia*, the difficulty in swallowing usually increases slowly, and the patient has also a dull, weighty, dragging, and often very painful sensation at the part, especially opposite the spine, which diminishes on lying down.

1597. The symptoms and accidents in this stricture of the *œsophagus*, are especially different in reference to its seat and extent, and particularly as regards the condition of the *œsophagus* above the stricture; as when, as is frequently the case, it is considerably expanded, the food that is swallowed, collects in great quantity, and is only afterwards thrown up.

The expansion of the walls of the *œsophagus* is either of the whole of the canal, or only partial, and depends on the protrusion of the internal coat between the separated fibres of the muscular coat, so that a sac of various size is formed (*Diverticulum, Hernia Œsophagi, Œsophagus succenturiatus,* &c.) This partial expansion occurs also frequently without any narrowing of the *œsophagus;* at least, I have never observed it with, but twice without stricture. It depends on the excessive expansion or tearing of some muscular fibres in the swallowing, and sticking of large, hard pieces of food, and the like. The food gets into this sac, expands it still more, and sooner or later, without any straining, is thrown up into the mouth. Whilst eating, the patient, when this sac is full and at the upper part of the *œsophagus*, must, as I have witnessed, empty it, from time to time, by pressure with the fingers, so that he may be able to swallow better.

1598. In the *scirrhous and callous*, *cartilaginous and bony*, *narrowing* of the *œsophagus*, which occurs, specially after the abuse of spirituous liquors, from the habit of eating and drinking very hot things, from the suppression of the ordinary discharges, from the venereal disease and alike, generally in advanced age, and in men, ulceration comes on at the later period, by which part of the stricture is destroyed, and symptoms of hectic consumption ensue. When these strictures are of long continuance, the ulceration always begins on the side next the stomach, which must be attributed indeed to the frequent efforts to vomit, by which the walls of the *œsophagus* below the stricture are deprived of their natural activity and natural moisture. The ulceration is usually seated on the hind wall of the *œsophagus* next the spine, and not unfrequently attacks the bones; it may, however, destroy the front wall and the corresponding part of the *trachea* or *bronchi*, and a communication may be produced between them, in which case most violent cough, choking on every attempt to swallow, and hæmorrhage are produced.

I have seen one case of callous stricture in a man sixty-three years old, in which there was a communication between the right *bronchus* and the *œsophagus.* Meyer (*a*) relates an instance of strictured *œsophagus* with a communication between the left *bronchus* and the *œsophagus.* Gendrin (*b*) communicates two cases of narrowing of the *œsophagus* at the region of the cricoid cartilage, in which there was also a fistulous orifice into the *trachea*, and cough in swallowing, vomiting fluids, speaking through the nose in consequence of the changed direction given to the air.

1599. In *narrowing of the œsophagus from fungous growths*, fluids usually pass with more difficulty than solids; if the food be again thrown up, it is usually mixed with bloody mucus, and membranous fibres, which even on examination with the sound, present a yielding obstacle and become attached to it.

1600. The *compression of the œsophagus by swellings* of any kind in its neighbourhood, can be ascertained by careful examination of the neck; the difficulty of swallowing corsesponds with the growth of these tumours, an *œsophagus* sound will pass more readily in this disease than in stricture. If such swellings be seated in the chest, the *diagnosis* is also more doubtful.

See also in Kunze (*c*) the different observations on these swellings.

Here also belongs the so-called *Dysphagia lusoria* depending on the unnatural course of the subclavian artery by which the *œsophagus* is compressed. Bayford (*d*) first described it under this name, and his observations have been confirmed by others. (Richter (*e*), Valentin (*f*), Autenrieth) (*g*). By some this cause of *Dysphagia* is denied, (Fleischmann (*h*), Rudolphi,) because the unnatural course of the subclavian artery has been noticed without this disease; and this notion is settled by Schönlein, as the origin of the dysphagy in this unnatural course of the subclavian artery depends on whether the artery pass before the *trachea*, between it and the *œsophagus*, or between it and the spinal column, in which latter case the disease must take place. The inconvenience first appears at the period of puberty, or on the suppression of menstruation, when the congestion towards the chest is greater. The symptoms are, violent palpitation and danger of suffocation on every attempt to swallow, accompanied with tremulous intermitting, and specially weak pulse in the right hand: the right arm is also shrunk and weaker; twisting movements of the neck frequently cause pain; all the inconvenience is in swallowing alone, and even then often only periodical.

1601. The *spasmodic stricture of the œsophagus* is usually seated more at the lower part towards the stomach, and is accompanied with the sensation of the tying together a fast-fixed substance; sometimes the organs of swallowing and the muscles of the neck are in spasmodic tension; the evil is increased by cold drinks, and diminished by hot ones. It is accompanied with spasmodic symptoms in other organs, qualmishness, vomitings, cough, secretion of a watery mucus, not unfrequently symptoms of suffocation, loss of speech, and the like. The spasm frequently intermits; this affection may, however, continue for a long while, which renders the *diagnosis* difficult; and also that, probably, during this long continuance, membranous stricture (*par.* 1594) will be produced. If spasm be added to organic stricture, the symptoms will be quickly increased.

(*a*) Med. Vereinszeitung für Preussen, 1836, No. 27.

(*b*) Journal des Connaissances Medico-Chirurgicales, Nov., 1837. See also Schmidt's Jahrbücher, vol. xxii. 1839; Oestr. medicin. Jahrbücher, vol. xxvii. pt. 2.

(*c*) Above cited.

(*d*) Memoirs of the Medical Society of London, vol. ii. p. 251.

(*e*) Chirurgische Bibliothek, vol. x. p. 365.

(*f*) Journal de Médecine, Chirurgie, et Pharmacie.

(*g*) Pfleiderer (Præs. Autenrieth) Dissert. de Dysphagiâ lusoriâ. Tubing., 1806.

(*h*) Neue Schriften der Erlanger phys. med. Gesellsch., vol. ii.

There is a difficulty in swallowing, which may amount to the greatest degree of dysphagy, dependent on a *chronic inflammatory*, and consequent spasmodic affection of the upper part of the *pharynx*, and which, on account of its usual connexion with impetiginous diseases, and the peculiar change of the mucous membrane of the *pharynx*, I have distinguished as *Angina impetiginosa.* This disease develops itself without any decided cause, and after a catarrhal affection of the throat. The difficulty in swallowing increases gradually to a very great degree, so that it is often quite impossible for the patient to swallow, and the smallest portion of food or drink is thrown up, with which there are also spasmodic contractions in the throat, and difficulty of breathing. It is a peculiarity in this complaint, that it is more difficult to get down fluids, than more consistent mucilaginous substances; there is often such dread of fluids, that when brought to the mouth there is the most violent spasm of the *glottis*, so that every attempt to swallow is impossible. If the throat be examined by proper compression of the tongue, the hind wall of the *pharynx* is found to be especially changed; the mucous membrane has a net-like or latticed appearance, and between the paler streaks are perceived a few light red island-shaped elevations. The redness is very indistinct, rather pale, and inclining to yellow; at several parts there is a sort of papular and phlyctenous formation. The patient complains usually, besides the difficulty in swallowing, of a burning or stabbing pain at some one part of the throat; he has often the sensation as if several little knots or bladders had formed and burst, after which a wound, very sensitive to the touch, remains for some time. These sensations, as well as their places, alternate irregularly. The patient has frequently the sensation of a circular contraction at the upper part of the *œsophagus.* I have noticed this disease in young and old persons, and always perceived a certain disposition to previous, though inconsiderable chronic affection of the skin. The resemblance of the symptoms may mislead to the presumption of an organic stricture, and many patients in this condition have been sent to me by distinguished practitioners; but an examination, with the œsophageal sound is, on account of the excessive sensibility of the throat, impossible, and the alternation of the symptoms, and especially the peculiar appearance of the back of the *pharynx*, can alone determine the *diagnosis.* The *treatment* is one of the most difficult questions. In a young man the disease had withstood, for many years, the most different and severe remedies, both internal and external, employed by several practitioners; at last he submitted to mine; but, up to the present time, the observations I have made point out no definite rule. Close consideration of all the previous circumstances, and constitutional relations, must lead the practitioner in the treatment, which requires equal perseverance on the part of both him and the patient. In one instance, repeatedly touching the back of the *pharynx* with lunar caustic seemed effective. To a certain extent this condition may be compared with the spasmodic contractions of the *sphincter*, in *fissura ani.*

1602. The *prognosis*, in stricture of the *œsophagus*, depends on the kind and seat of that affection. The simple, membranous stricture admits a favourable *prognosis*, and may be completely got rid of by proper treatment. Callous and scirrhous stricture rarely allows any check to its development, and, when once existing, its alleviation is scarcely possible, and still less its cure. Spasmodic stricture may mostly be got rid of by proper treatment; the disease however often recurs, is frequently very stubborn, and may run into organic stricture. In swellings which compress the *œsophagus*, the *prognosis* depends on their nature and seat.

[Astley Cooper (*a*) mentions a case in which, during stricture of the *œsophagus*, an aperture was made from it outwards by ulceration; the patient was kept alive some time by administering food through an elastic catheter.—J. F. S.]

1603. In those cases in which the alteration of the mucous membrane of the *œsophagus* depends on chronic inflammation, a strict attention to the mode of living accompanied at first with antiphlogistic treatment, repeated leeching, the continued internal use of hydrochlorate of ammonia, of hemlock, of mercury, of iodide of potash, with simultaneous derivation by issues, tartar emetic ointment, setons, and the like, together with carefully-regulated living, are required. The progress of the stricture is, however, rarely checked by these means; and its existence may be

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(*a*) MS. Lectures.

ascertained, in addition to the symptoms described, by the introduction of a sound, in the way presently to be described, which finds a distinct obstruction, and is stopped at the seat of stricture.

1604. The introduction of an œsophageal sound is the most simple remedy to get rid of an existent narrowing, by gradual extension. This treatment in membranous stricture ensures a satisfactory result; in callous and scirrhous stricture it is never, according to my experience, to be relied on. The introduction of the sound has frequently only the palliative effect of prolonging the patient's life, by the passage of food into the stomach. In such cases, however, the irritation of the sound may, without delay, drive on the stricture into malignant degeneration and ulceration.

1605. The introduction of a sound into the *œsophagus* must be conducted with the greatest care and delicacy, or otherwise injury to the walls of the *œsophagus*, false passages, and hastening the miserable end of the disease will be produced. The following is the best mode of proceeding. The patient sits upon a chair, his head moderately thrown back, and held by an assistant, his mouth wide open, and tongue a little protruded (1). The œsophageal sound provided with a leaden stilette, oiled, and a little curved at its tip, is then introduced into the gullet, and gently pushed onwards. When it has reached the seat of stricture, care must be taken, and an attempt made, by gentle pressure, to overcome the obstacle, over which it usually slips with a jerk and can then be passed still farther. If it be impossible to get through the stricture with the sound, a thinner one must be chosen and used in the same way. In some cases of great narrowing, I could only succeed, after several fruitless attempts with the thinnest œsophageal sound, in passing through the stricture with a moderate-sized urethral sound. The instrument thus introduced, and the stilette withdrawn, must be allowed to remain as long as the patient can, without much inconvenience, bear it, which at first will not exeeed five minutes. In general, the swallowing after this first introduction of the sound, very small though it be, will be remarkably improved. The sound should be passed daily in this manner, and allowed to remain a little longer, so that the parts may become accustomed to the irritation, and then by degrees a thicker sound may be used.

The introduction of the sound through the nostril is improper, much more painful to the patient, and, if it be thick, impossible; by this mode also the instrument more frequently slips into the windpipe, than in passing it by the mouth. This is proved by the violent disposition to cough, by the expulsion of the air with the sound, and the impossibility of speaking; it is right, however, to observe that frequently the disposition to cough, although the sound be thrust into the windpipe, is not so great; and that by the choking, when the sound is in the *œsophagus*, the air may be forced up from the stomach with a hissing noise.

The introduction of the sound, provided with a leaden stilette, if the instrument require passing to a great depth, has the advantage of giving to it every desirable and suitable curve. The sound can be introduced with the greatest safety, without interfering with the curve of the leaden stilette and is rendered more steady than without it. In very narrow strictures, in which the thinnest sound will not penetrate, it is better to employ the thinner urethral sounds than that the obstacle should be overcome with violence, as Boyer (*a*) did in one case, in which he employed a silver catheter, passing it through the mouth, and, having passed the obstacle, then introduced an elastic sound, the end of which he carried by the assistance of Bellocq's tube into the nostril. Any great force used in introducing an œsophageal sound endangers tearing the walls of the *œsophagus*. I knew one instance abroad, in which the sound penetrated the hind wall of the *œsophagus* above the stricture, proceeded some distance between it and the spine, and below again entered the *œsophagus*, as proved by dissection. In difficult cases,

(*a*) Richerand, Nosographie Chirurgicale, vol. iii. p. 262. Third Edition.

a sound, made of modeller's wax, may be employed, with which slight pressure may be made against the stricture, and an impression of it obtained as I have sometimes observed (2).

[(1) The practice here recommended, of protruding the tongue, preparatory to passing the sound or bougie, and which, I believe, was first recommended by **Home**, is very objectionable, as in proportion must the *epiglottis* be raised, and greater facility for the entrance of the instrument into the windpipe afforded. Moreover, it is quite needless, as the passage into the beginning of the *œsophagus* is rendered easy by placing two fingers of the left hand upon the tongue, and pressing it into the bottom of the mouth, which readily exposes the whole cavity of the *pharynx*.

(2) **Astley Cooper** (*a*) used to mention a case of this kind; he had been called to a person with stricture of the *œsophagus*, and had attempted to introduce an urethral bougie, but in vain. Another Surgeon was called, who passed an instrument, with readiness, as he said, and then injected some milk and wine through it. A swelling immediately arose at the upper end of the breastbone, and the patient cried out, "Oh! you burn me." The same evening the man was dead. The instrument had been thrust through the *œsophagus* into the anterior *mediastinum*, into which the fluids had been poured. The preparation of the parts is in the Museum at St. Thomas's Hospital. —J. F. S.]

1606. If in this way much expansion of the stricture can be effected, and swallowing be in a corresponding degree improved, for the purpose of sustaining a continual cure, a sound with an olive-shaped dilator must be used, which after some days must be changed for a thicker, and, according to circumstances, for the thickest. In introducing a sound with a dilator, as in passing a common sound, care must be taken that the dilator be pushed gently through the seat of stricture, which is distinctly marked by the resistance. The instrument is either moved up and down a few times through the stricture, or, when it is ascertained that its thick part is in the stricture, it may be left there for some time, and then drawn back. I have never observed that in thus doing the patient has suffered much inconvenience. The sound with the dilator is generally borne as well as the common œsophageal sound. When the swallowing has become perfect, the sound should not be given up, but passed once a week or fortnight, to counteract the disposition to narrowing again, which I have also endeavoured to prevent by introducing a seton in the neck for some time.

This treatment has, in all cases of membranous stricture in which I have employed it, effected a permanent cure. The dilator is either made of ivory, slipped on the sound at some distance from its tip, and there fastened, or the sound itself is furnished with a bellying enlargement of caoutchouc at the same place. These dilators are of various thickness, up to an inch in diameter. The mere introduction of a common sound, up to the largest size, may relieve and improve the patient's condition for some time, and may produce even complete freedom of swallowing; but a permanent result is not thereby commonly produced; earlier or later the disease recurs.

The use of bougies, armed with lunar caustic, for the destruction of stricture of the *œsophagus* (*b*) must be considered highly dangerous in every form of the disease. **Jameson** (*c*), instead of the gradual violent extension of the stricture, employs an oval ivory dilator, which he uses either alone or with a sound, or with a sound armed with a bullet, passed three or four times through the stricture.

Fletcher (*d*) uses a metallic instrument, which either serves for tearing, or merely dilating the strictured *œsophagus*. It is curved in front, consists of three close-lying branches, and, when the instrument is introduced into the stricture, they are separated by twisting the handle. The use of this instrument is, in my opinion, accompanied with great difficulty, and, in stricture deeply situated, it is not at all efficient. The introduction of a whalebone stem, commonly known as a probang, with a sponge (*e*) for the purpose of expanding the stricture, is not proper.

(*a*) MS. Lectures.

(*b*) **Home**, above cited.

(*c*) Philadelphia Medical Recorder, Jan., 1825.

(*d*) Above cited.

(*e*) **Gendrin**, Du Cathéterisme curatif du Rétrécissement de l'Œsophage; in Journal des Connaissances Médico-Chirurgicales. Nov., 1827.

1607. In membranous stricture, besides the above-described, no further treatment is necessary. In callous and scirrhous stricture, the previous mentioned (*par.* 1603) treatment, both internal and external, must be simultaneously employed. Spasmodic stricture requires the use of antispasmodic remedies, especially ipecacuanha in small doses, and the application of *emp. belladon.* around the neck. The introduction of the sound has often, in these cases, better effect than any other treatment.

In *Dysphagia lusoria*, the congestion about the chest must be relieved by strict attention to the mode of living, the blood must be diverted to the lower parts, suppressed menstruation restored, and the like. AUTENRIETH recommends also the frequent introduction of the œsophageal sound, for the purpose of relaxing the *œsophagus*, and to lengthen and strengthen the cellular tissue connecting that tube to the arteries.

1608. If the sound be used for the purpose of introducing strong broths, one should be employed which has a funnel-shaped horn mouthpiece. The sensation of warmth which the patient feels in the epigastric region is a proof that the fluid has entered the stomach. Previous to administering the fluid, attention should be paid to the symptoms described (*par.* 1605) as occurring on accidental introduction of the sound into the windpipe.

The *Dysphagia paralytica atonica*, which occurs in old persons after apoplexy and nervous diseases, in which the patient cannot mention any decided obstacle, any pain, or tightness does not offer any opposition to the sound, and the breathing is not interfered with; tough mucus is often spat up; solid food and bits of bread usually pass better than fluids, sometimes better when swallowed slowly and in the upright posture; and frequently there is a greater or less degree of accompanying palsy of the tongue. The introduction of the elastic sound is required when the patient cannot be sufficiently nourished. I have found gargles of *tinct. rad. pyrethri* especially useful, also blisters to the neck, and arnica.

VIII.—OF NARROWING AND CLOSURE OF THE RECTUM.

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1609. *Closure of the Rectum* (*Imperforatio, Atresia Ani*, Lat.; *Verschliessung des Mastdarmes*, Germ.; *Imperforation du Rectum*, Fr.) is always a vice of the first formation; but *Stricture* (*Strictura Ani*, Lat.) *Verengerung des Mastdarmes*, Germ.; *Rétrécissement du Rectum*, Fr.) most usually arises subsequently, and is rarely congenital.

1610. The congenital closure of the *rectum* depends either on a simple membrane, which more or less resembles the general coverings or the intestinal membrane of the gut, and is situated either immediately at the anal aperture, or more or less high in its cavity; or there is not a trace of *anus*, and the *rectum* opens more or less high in a blind sac. Those cases of congenital malformation must be now also mentioned, in which the *rectum* opens into the urinary bladder, *urethra*, or some other aperture, whilst the *anus* is closed.

Compare **von Ammon** (*a*) upon the unnatural openings of the *anus*, and the other malformations therewith connected.

1611. Closure of the *rectum* always causes violent forcing and straining; with which, nothing being discharged by the *anus*, painful tension of the belly, vomiting of green or yellowish matter, arise; and to these symptoms convulsions are afterwards added. If the *rectum* be closed by a simple membrane, it is, especially when the child cries, protruded like a sac, and the *meconium* is seen through it. If the closing membrane be higher, it is ascertained by the introduction of the finger or of an elastic sound.

[Although imperforation of the *anus* or *rectum* is generally soon discovered by the child not passing motions, yet a case is mentioned by **Wolff** (*b*), in which it was not found out till the evening of the twelfth day after birth, when the child was attacked with vomiting, hiccough, and convulsions; the belly was very full and tender. The *anus* was found imperforate, but the gut could not be opened by a lancet thrust in to the depth of two inches. A pharyngotome was then passed up, and with it an aperture made, and by the use of clysters and tents the child ultimately recovered.]

1612. If the external opening of the *rectum* be closed by skin, it is sufficient to thrust into it a straight bistoury, and to enlarge the wound with a button-ended bistoury on a director; and, if it seem necessary, the flaps thus formed may be removed with the scissors. If the closed part of the *rectum* be higher up, a narrow, straight bistoury must be introduced, in a proper direction, upon the forefinger of the left hand, or upon a director, through the closing membrane, and the opening thus made enlarged with the button-ended bistoury; a trochar or a pharyngotome will answer the same purpose. This treatment is, according to the kind of closure, accompanied with more or less difficulty; the expanded part of the *rectum*, instead of the seat of closure, may be lighted on, and fatal effusion into the *pelvis* follow. The closed part may be hard, callous, car-

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(*a*) Cited at head of article.

(*b*) **Langenbeck**'s Bibliothek, vol. iii. p. 231.

tilaginous, and very thick. To prevent the re-closure of the *rectum*, it is necessary to insert a plug of lint, fastened up with strips of sticking-plaster, and with a thread attached to it, for a long while in the cavity of the gut, or to introduce the finger, well oiled, from time to time into the *rectum*, as the disposition to re-close is often very considerable (*a*).

1613. When there is no trace of an external anal opening, the difficulty of the operation depends on the higher or lower position of the blind end of the *rectum*. If there be no fluctuating swelling, no accompanying projection or depression, which can direct the practitioner, he then, after carefully introducing a catheter into the bladder, and in a female a sound into the *vagina*, for the purpose of emptying the urine, and distinguishing, during the operation, the position of the bladder and *vagina*, makes a cut with a pointed bistoury between the beginning of the *raphe* and the *coccyx*, in such way, however, that there be an inch distance between the latter and the cut, as in children the *rectum* does not lie so close to the *coccyx* as in adults. Having penetrated about half an inch, the finger of the left hand must be introduced into the wound, the blind end of the gut sought for, and then the cut is to be cautiously continued more deeply, following, as far as possible, the course of the straight gut, and taking care not to wound the bladder or *vagina*. When the cavity of the *rectum* is penetrated, the aperture made must be enlarged with the button-ended bistoury, on the finger or on the director, and the dressing to prevent the re-closure applied in the usual way. If the penetration have reached a depth of two inches, without coming to the gut, it has been advised to proceed with the operation by thrusting a trochar towards the blind end of the *rectum*; the objection, however, seems to be correct, that the operation is equally hazardous and useless, as, although the gut may be opened, effusion of *meconium* into the belly is the consequence (*b*). Here also may be mentioned AMUSSAT's (1) mode of practice, in which he draws forth the blind sac of the intestine exposed by the cut, opens it, and attaches the cut edges of the gut to the edges of the external skin.

(1) AMUSSAT (*c*) found, on introducing his finger into the *vagina*, a movable body on the top of the sacro-vertebral articulation, which he took for the end of the *rectum*. He made one transverse cut behind the proper seat of the *anus*, and then another which reached the *coccyx*. Through this ⊤ cut he introduced his finger, carrying it along the *sacrum* to the end of the gut, and therewith broke down the adhesions; he then drew the intestine, with a pair of forceps, to the external opening, cut into it, and fixed it with two stitches, so that the mucous membrane overlapped the edge of the external skin.

[Sometimes the two portions of the ileo-colic valve are adherent to each other, so as prevent the passage of the *meconium*, and lead to the presumption of the large intestine being imperforate in some part of its course. A case of this kind occurred to me at the General Lying-in Hospital, in the summer of 1842. The child was born at 1 A.M., June 6; and some hours after, no motion having passed, castor oil was given, but did not operate. On the evening of the same day, an elastic catheter was introduced into the *rectum*, to the extent of two or three inches, and no obstruction being met with, the castor oil was repeated, but did not produce any stools. On the following morning an attempt was twice made to throw up an injection, but it failed; and Dr. FERGUSSON, whose case it was, considering it as one of imperforate *rectum*, desired I should see the child; and on the evening of this day I saw her. On examination, I could pass my finger up about two inches, but not farther, and the gut seemed to terminate in a blind pouch; no sensation of fluctuation above could be felt; and I therefore did not consider myself justified in passing a trocar, without knowing where it might go; but, being desirous to give the child a chance of life, I determined on making an artificial *anus*. For this purpose I cut upon the *linea alba* about half an inch above the *pubes*, and, opening

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(*a*) HENKEL, Neue Bemerk., fasc. i. p. 11

(*b*) ZANG, Darstell. blut. heilk. Operat., vol. iii. pt. ii. p. 436.

(*c*) Archives générales de Médecine, 1835. p. 237.

the *peritonæum*, caught up a portion of small intestine, and having cut into it, fixed the cut edges by stitches to the wound in the *linea alba*. Soon a quantity of *meconium* passed, and continued to do so on the day following; but on the third day she began to vomit bile and frothy mucus, and at 2 P.M. died. On *examination*, the gut was found adherent to the wound. The *colon* was quite empty and contracted to the size of a crow-quill, but it was continuous with the *rectum*, and both intestines were quite pervious. The finger had been prevented passing up the *rectum* by a sudden turn, at which part it was close bound down to the *sacrum*. The *jejunum* and *ileum* were much distended with fæcal matter; and on slitting open the latter, the two portions of the ileo-colic valve were so nearly adherent, that nothing would pass through, although there was a very small aperture.—J. F. S.]

1614. When the *rectum* opens into the *vagina*, a director must, if possible, be introduced through the latter into the *anus*, thrust down vertically, and, when its position has been ascertained by the forefinger, a straight bistoury or a trochar must be thrust through the closed anal aperture, towards the groove of the director, and the puncture afterwards enlarged in the manner described. This practice is, however, generally fruitless, and it is preferable to divide, through the *vagina*, all the parts back into the *rectum*, and by the insertion of lint, or, still better, by the daily introduction of the finger, oiled, to prevent the re-union.

In one case, in which this treatment was in vain, as the artificial opening of the *rectum* closed again, whilst the opening of the *vagina* remained, BARTON (*a*) employed the following method with success. He passed a director through the hole of communication in the *vagina*, and divided the whole wall of the *vagina* to the place where the natural opening of the *rectum* should be. He did not use any dressing, but every day passed the finger, smeared with cerate, into the *rectum* to prevent it closing. The *vagina* was perfect, and the *rectum* had a direct opening, except that the stools passed involuntarily. SATCHELL (*b*) also, and I myself have by this practice obtained like favourable results. VELPEAU (*c*) had proposed this operation on the recommendation of VICQ. D'AZYR. After the division is perfected, a canula should be introduced into the *rectum*, fixed towards the hind angle of the wound, by means of which the aperture must be preserved, and the divided parts enabled to unite in front.

DIEFFENBACH (*d*) introduced a director much bent inwards, through the *vagina* into the aperture of the *rectum*, thrust a pointed bistoury close behind the *fossa navicularis* into the groove of the director, and cut out from thence with the point of the knife, at the same time dividing the whole *perinæum* and widening the aperture of the *anus*, at a single stroke, to near the *coccyx*. The *rectum* was laid bare by the division of the cellular tissue, stretching forwards to the *vagina*, and presenting at the bottom of the wound. He then dissected the edge of the *rectum* from the wound he had made, divided to the extent of an inch in the direction of the external skin and the muscular wound, and fastened the separated edges of the *rectum* on each side of the cleft *perinæum*. The aperture of the *rectum* in the *vagina* closed very completely during the after-treatment by occasionally touching it with lunar caustic. On the complete cure of all the wounded parts, three weeks after the first operation, the formation of a new *perinæum* was attempted. The hind surface of the open end of the *rectum* was farther separated from the *vagina*. The portion of intestine thus set free in the middle, contracted remarkably, and receded about four or five lines. The scar of muscle and skin was removed from the thus formed interstice, the deeper-lying parts were brought together with a needle-stitch, but the edges of the wound with two very short harelip-pins and the twisted suture. The cure was completely successful.

1615. When the *rectum* opens into the *urethra*, a sound must be passed by the latter into the bladder, and the unnatural opening in the *urethra* divided upon it towards the *coccyx*, and with some cautious strokes of the knife the aperture in the *urethra* and the wall of the intestine opposite the place of the *anus* divided. If possible, the sound should be brought through the unnatural opening in the *urethra*, into the cavity of the

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(*a*) Medical Recorder of Medicine and Surgery. Philadelphia, 1824.

(*b*) Ibid.

(*c*) Elemens de Med. Oper., vol. ii. p. 979.

(*d*) Ueber die Verschliessung des Afters; in HECKER's Annalen. 1826, Jan. p. 31.

rectum, and such direction given it, that it may be distinctly felt from the *perinæum*, and the covering of the *urethra* divided in the course of the *raphe*, together with the wall of the straight gut opposite the place of the *anus*, or treated according to Amussat's plan (*par.* 1613.)

When the *rectum* opens into the urinary bladder, it is possible for a girl to live, on account of the shortness and extensibility of the *urethra;* but in a boy this malformation is fatal, if the wall of the *rectum*, opposite the place of the *anus* be not open, or an artificial *anus* made.

In a case, in which the *rectum* was imperforate, and opened into the bladder Fergusson (*a*) made a cut into the neck and body of the bladder at the place of the *anus*.

[Cruvelhier (*b*) gives an instance in which the *rectum* opened under the *glans penis*, by means of a canal which was formed in the substance of the *raphe scroti*. A similar case to this occurred to me, and will be described at the end of *par.* 1617.—J. F. S.]

1616. In all cases, where, by the above-mentioned modes of treatment, opening the imperforate end of the *rectum* is impossible, or when the *rectum* terminates by a blind end in the belly, as also in the not-to-be-overlooked narrowing of the *rectum* by unreachable strictures and the like, some assistance, though not much, may be afforded by the formation of an artificial *anus* at the lower end of the *colon*, (*laparo-colotomia*,) which may be performed in two ways. *First*, A cut from an inch and a half to two inches long is to be made obliquely from behind forwards, so that its lower end should be a little below the upper front iliac spine, and half an inch from it, and continued, layer after layer, through the skin and muscles; the *peritonæum* is then carefully opened, raising it with the forceps, and the sigmoid flexure of the *colon* sought for, drawn to the wound, two waxed threads carried round it, and a longitudinal cut having been made in it, returned into the belly; and, by means of the threads, retained between the edges of the external wound with which it unites (1). *Second*, In order not to wound the *peritonæum*, a cut, three inches in length, must be made, according to Callisen's (2) method, in the left lumbar region, between the iliac crest and the short ribs, on the front edge of the *m. quadratus lumborum*, at which part the descending *colon* lies enclosed in cellular tissue external to the *peritonæum*, and is here to be opened (*c*). Amussat makes a transverse cut two inches above the iliac crest, from the outer edge of the *m. quadratus lumborum* to the middle of the iliac crest, through the skin and abdominal muscles, thus cutting across the *m. transversalis* and its aponeurotic layer, then separates the fatty tissue which covers the gut, passes two threads through its wall, to prevent it falling together; then stabs the *colon* with a trocar, enlarges the aperture with the bistoury in several directions, and connects it by four stitches to the front corner of the wound (3).

(1) This operation was proposed by Littre in 1720; but first practised successfully by Dinet in 1793 (*d*). See also Freer (*e*).

(2) This mode was tried by Roux without success.

(3) Amussat has performed this operation successfully in a woman of forty-eight, and in a man of sixty-two years of age (*f*).

Pilore (*g*) made an artificial *anus* on the right side, by which he opened the *cæcum*

(*a*) Edinb. Med. and Surg. Journ., vol. xxxvi. p. 363. 1831.

(*b*) Anat. pathol., livr. i. pl. v. 1. fig. 6.

(*c*) Systema Chirurgiæ Medicinæ, vol. ii. p. 842. Hafn., 1817.

(*d*) Sabatier, Méd. Opér., vol. ii, p. 336.

(*e*) Pring; in London Medical and Physical Journal, vol. xlv. p. 9. 1821.

(*f*) Mémoire sur la possibilité d'établir un Anus Artificiel dans la région lombaire sans pénetrer dans le péritoine. Paris, 1832.

(*g*) Actes de la Société de Lyon. 1797. p. 189

as previously advised by **Benjamin Bell**, and as was to be done in the immobility of the S. Romanum.

The formation of an artificial *anus* has been also proposed in adults, for the not-to-be-overlooked narrowing of the *rectum* from unreachable strictures, and the like. **Freer** (*a*) made a longitudinal cut, of three inches, in the left iliac region, about an inch above the upper front iliac spine, and an inch and a half in front of it, laid bare the *colon* fastened it with two stitches in the wound, and opened it longitudinally to the extent of two inches. The patient died on the *tenth* day. **Pring** (*b*) made a cut obliquely downwards, and inwards two inches above, and an inch on the inner side of, the front iliac spine, to within three-quarters of an inch of **Poupart**'s ligament, through the skin and muscles; opened the *peritonæum*, and enlarged it to three inches. The sigmoid flexure of the *colon* was laid bare to the wound. The result was successful.

Compare also **Martland**, a case in which the operation for artificial *anus* was successfully performed; in Edinb. Med. and Surg. Jour., vol. xxiv. p. 271. 1825.

Svitzer, E., Anotationes in Colotomia. Hafniæ, 1827.

Oettinger, Ueber die angeborene Aftersperre. München, 1826.

Löper, Dissert. de Vitiis fabricæ primitivæ Intestini Recti. Wirceb., 1827.

Klewitz; in Med. Zeit. des Verein. für Heilk; in Preuss., No. 17, 1835,—No. 22, 1838.

Although in imperforate *anus*, if no assistance be rendered, fatal consequences ensue, in consequence of the stools not being passed; there are, however, instances in which, with imperforate *anus*, and even with accompanying deficient urethral opening, life has been sustained months (*c*), and even years (*d*); in which cases the stools have been vomited by the mouth.

1617. When the *anus*, though not imperforate, is yet congenitally narrowed, the existing aperture must be enlarged by means of a button-ended bistoury and director, and then its reunion prevented by the introduction of lint. This congenital narrowing of the *rectum* may be to such extent, that so long as, during infancy, the stools have little hardness and thickness, it is of no consequence, but as the child grows, and the motions become larger, inconvenience arises (*e*), and the treatment must be such as already mentioned.

[I had under my care, very many years ago, a case of imperforate anus (*f*), similar to that mentioned by **Cruvelhier**. At the time of birth there was not any opening, but a slight puckering marked the place of the *anus*, and this was protruded each time the child cried. In front of the *scrotum*, and in the track of the *raphe*, as it passed on to the prepuce, was a small aperture, just large enough to admit the entrance of a probe, and from it, when the child cried, a small quantity of *meconium* passed. I cut upon the puckered skin, but it was full an inch before the *rectum* could be reached, and I then opened it sufficiently to admit a large urethral bougie, and the *meconium* readily escaped. A probe, introduced at the opening before the *scrotum*, passed along a canal, beneath the *urethra*, through the *perinæum*, becoming larger and larger as it approached the *rectum*, in which it terminated. No bougie, or anything else, was left in, as I thought keeping the bowels loose would have been sufficient to prevent union; however, in the course of a fortnight the wound had closed, and no motion was passed, except by the aperture in front of the *scrotum*. I therefore had to cut into the *rectum* again, and a piece of bougie was then introduced, to be worn constantly, but removed three or four times a-day, for emptying the bowels. This went on very well for a time, but, probably, from negligence, the scar contracted, and at the end of three months the anal opening would not admit even the point of a probe. The scar was, therefore, again divided, and a larger bougie introduced, and worn for a fortnight, after which, a short pewter pipe, about the thickness of the little finger, with a circular shoulder to prevent it slipping entirely into the gut, was introduced, so that the motion might pass continually by it, and the opening be established. Two months after, the pipe having slipped out, and been neglected, the opening had again closed, and again required enlarging with the knife to readmit the tube. The parents' negligence again compelled

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(*a*) Above cited, p. 31.

(*b*) Above cited, p. 4.

(*c*) **Delamarre**; in Journ. de Médecine, vol. xxxiii. p. 510. 1770.

(*d*) **Baux**; in same, vol. viii. p. 59. **Bartholin**, Historiæ Anatomicæ, Cent. i. Obs. 65, p. 113.

(*e*) **Boyer**, Traité des Malad. Chirurg., vol. x. p. 3.

(*f*) St. Thomas's Hospital Reports, p. 121. London, 1836. 8vo.

the dilatation of the aperture with the knife, and a large bougie was directed to be passed frequently. I did not again see him until he was seven years old, when he was a well-grown boy, but with an enormously distended belly. The *anus* continued open, though not very sufficiently, and the orifice before the *scrotum* was still open, and, occasionally motion passed by it. I was desirous of removing this unnatural canal, but the mother was averse to it, and the child's unhealthy appearance did not lead me to expect that he would live very long. I had entirely forgotten him, when, eleven years after, (he being then eighteen years old,) I was surprised on seeing a fine healthy young man, who said he was the person on whom I had previously operated. The appearance of the *anus* could be compared to nothing else than a bullet-hole in a board: he said he had no difficulty in passing or retaining his motions; but it was quite evident, from his linen, that there was a continual oozing. The opening in front, instead of being near the *frænum præputii*, was now close to the *scrotum*, and a small quantity of stool occasionally escaped from it. On examining more closely, I found the anal orifice completely filled with a protruded portion of the lining of the *rectum;* it, however, offered no obstruction to the finger, which readily passed up as far as the knuckle, and was received into a large cavity full of fæculent matter, and running forward along the *perinæum*, beneath the membranous part and the bulb of the *penis*, to the back of the *scrotum*, where the canal narrowed, and would only admit the finger; with this the opening before the *scrotum* communicated. It was curious, in this case, that although there was an entire absence of the *sphincter* muscle, the stools did not pass involuntarily; the protruded fold of the internal membrane seemed to form a valve which prevented ordinarily the escape of the stool, and compensated the deficiency of the *sphincter*. I proposed to him the removal of the continuation of the bowel into the *perinæum*, but he would not submit to any operation. I have not seen him for the last eleven years.—J. F. S.]

1618. The narrowing of the *rectum*, which takes place in later years, arises either *from spasmodic contraction of the m. sphincter ani*, or *from a thickening, swelling, or degeneration of the mucous or other membranes of the rectum*, or *from swellings in the neighbourhood of the rectum*, or *from large scars*, which have formed near the anal aperture.

1619. The *spasmodic contraction of the anus* is, for the most part, accompanied with a fissure, or with a cleft in the folds of the *sphincter* muscle; though it is, however, seen without either. Adults appear to be almost exclusively subject to this complaint, and women more frequently than men. Its causes are very obscure; it is frequently preceded by hæmorrhoidal congestion, or it occurs after the removal of piles. It is more probable, according to some, that the fissure is produced by the spasmodic contraction, than that the latter is caused by the fissure. From my own observations, however, I hold the contrary opinion.

1620. The disease develops itself very stealthily; at first the motions are accompanied with heat and burning, which, however, gradually subside, and often cease entirely, if the patient take heating drinks, use clysters, and wash frequently with cold water. The sensation of heat and burning soon, however, returns, and continues for a longer time, after going to stool. The relief of the bowels is mixed with blood, the pain increases; aperients, clysters, and cooling diet, indeed, produce alleviation, though only for a short time, and the complaint proceeds in spite of their employment. Going to stool becomes so difficult, that the bowels can often only be forced every forty-eight hours, by a purge, by repeated clysters, or injections thrown up every hour. If the costiveness continue several days, the relief is followed by pain as severe as if a hot iron were thrust into the *rectum;* even convulsions and fainting may ensue, and after the relief of the bowels, there remain pain, shooting, and beating, as in an inflamed part. Every violent effort, the use of too heating food, or food taken in too great quantity, always aggravates the complaint, and the patient, therefore, usually takes but little nourishment. In females, the pain often increases at the coming on of the menstrual periods, and also arises from every exertion, cough, jumping, making water, and the like. Some patients, in this disease cannot sit, whilst others cannot stand. In consequence of this contraction, very large quantities of stool are retained, the pressure of which, against the *anus*, causes long-continued and fruitless straining, and its discharge can only be produced by injections, or by the mucus which the intestine secretes; even the escape of air is often accompanied with pain. When the disease has long continued, wasting takes place from the severity of the pain, and disturbance of the rest, very great sensibility, often hypochondriasis, and affections of the neighbouring organs, as retention of urine.

1621. On examining the external orifice of the *rectum*, hæmorrhoidal tumours or little knots are often found; also, in some cases, a slight discharge, which symptoms, according to Boyer, not in immediate relation with the complaint, on the contrary, are so, according to my experience, as, after the removal of such knots, I have noticed a speedy cure. In those cases in which contraction of the *anus* is accompanied with fissure, the lower end of the latter is found at the part where the patient feels pain, usually in the right or left side of the circumference of the *anus*: in most cases it, however, can only be seen, when the buttock of the affected side is forcibly drawn back, and the anal orifice drawn a little asunder, in many cases, indeed, the fissure cannot, even in that way, be discovered. The introduction of the finger into the *rectum*, which always causes severe and almost unbearable pain, if it press on the fissure, discovers a violent, permanent contraction, but neither swelling nor hardening of the mucous membrane: but at one spot, a lengthy indentation running the length of the intestine may be found; or the fissure is distinguished by the peculiar pain which the patient feels when pressure is made upon it.

[Brodie observes, that, "in connexion with the spasmodic contraction of the *sphincter* muscle, you will frequently find a small ulcer of the mucous membrane of the *rectum*. This ulcer is always in a particular spot, at the posterior part, opposite to the point of the *os coccygis*. I imagine that it arises from the mucous membrane there being torn by the pressure of the hard *fæces*, at the time that the evacuation is labouring, as it were, to get through the contracted orifice of the *anus*. Such an ulcer as I have just described adds very much to the patient's sufferings. It is always excessively sensitive; the least pressure of the finger upon it occasions the patient the greatest pain, and the pressure of solid *fæces* produces the same effect. (p. 26.)

Bushe (*a*) speaks of another form of spasmodic contraction of the *sphincter ani*, in which no primary affection of the gut is discoverable, and in which the introduction of the finger into the gut does not give pain. (p. 126.)]

1622. Spasmodic contraction of the *anus* may be distinguished from its narrowing, by the swelling, and by the disorganization of its mucous membrane, by the pain which accompanies going to stool, and continues some time after, by the absence of discharge of matters, by the long-continuance of the complaint, and by the introduction of the finger beyond the contraction of the *sphincter*, discovering neither tubercle nor hard ring formed by the internal membrane of the *rectum*. The characteristic sign is the fixed pain at one spot of the circumference of the *anus*. It must not, however, be overlooked, that continued spasmodic contraction of the *rectum* gradually causes a greater development and activity of the *sphincter*, as well as plastic exudation, organic changes, and thickening of the gut itself from the constant irritation.

1623. The remedies employed for spasmodic contraction are, cooling

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(*a*) Above cited.

treatment, the avoidance of all heating food and drink, frequent use of gentle purgatives, and clysters several times a-day, steam-baths of hot water, decoction of chervil, infusion of elder flowers, cold hip-bath, whole or half bathing, application of leeches, narcotic injections, suppositories of *opium*, *hyoscyamus* and *belladonna*, a dram of acetate of lead, a dram of extract of *belladonna* with six drams of fat, according to Dupuytren's prescription, opiate ointment; also, a salve, composed of equal parts of lard, expressed juice of houseleek, nightshade, and sweet almonds. These remedies, indeed, relieve the patient, but are nearly always inefficient for the cure, and even commonly for assuaging the complaint (1). Any attempts to enlarge the anal orifice with bougies, according to Boyer and others, increases the pain and contraction. Beclard (*a*) has, however, employed masses of lint, of gradually increased thickness, to cure the spasmodic contraction of the *rectum* without fissure. According to Delaporte (*b*) the bougie should be smeared with *belladonna* ointment. He prefers this to cutting, and does not object to touching the fissure at the same time with caustic, by which the pain is suddenly got rid of: he mentions instances in which cutting was of no service. According to Bushe (*c*) all purgatives should be avoided, as they always irritate; a linseed clyster daily, together with careful cleansing of the parts, is preferable. If the disease be slight, the application of lead ointment may be sufficient, and in violent spasm, extract of *belladonna* at the same time. In superficial fissures, lunar caustic should be used, and with it a dressing of lint spread with one part of extract of *belladonna*, and seven parts of *ung. rosat.* (2). According to Pagen (*d*) the parts should be smeared with a mixture of opium cerate and extract of *monœcia;* and Bretonneau (*e*) recommends fomentations of rhatany. I have, in some instances, effected a cure at the beginning of the disease with bougies smeared with zinc ointment, or by its introduction. We should always examine the *anus* very closely, touch every part with the finger, especially every knot, and remove it, if painful. I have ascertained by experience, that spasmodic contraction of the *anus* is more frequently the consequence of seemingly trifling things, than is usually supposed. Similar symptoms are often observed, from the trifling ulcerations, and little excrescences about the female *urethra*, after the cure or removal of which, the most severe symptoms of difficulty in making water quickly subside. I have ascertained that, in such cases, the disease may be got rid of, at first, by the removal of such excrescences, or the cure of the fissure, but which is often useless, if too long delayed till the abovementioned changes of the *rectum* have occurred (3).

(1) Only in one instance, where the fissure was accompanied with moderate contraction, was the cure effected by Boyer's treatment. I noticed this once in a fissure, with violent contraction and very severe pain, in a woman.

[(2) Brodie objects to the use of the *belladonna*, as, "even in the form of a suppository, it sometimes produces very serious symptoms by its influence on the brain." (p. 26.)]

(3) In one case, in which the spasmodic contraction of the *anus* was accompanied with most severe pain, I found, on examination, a fissure, and with it a very small red knot; I first cured the fissure by frequently touching it with a solution of corrosive sublimate, which gave relief, and then by the removal of the little knots, an immediate cessation of all spasmodic contraction, and a complete cure ensued.

1624. The surest mode of getting rid of the contraction, either with

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(*a*) Bulletin des Sciences Méd., 1825, p. 199.

(*b*) Revue Médicale, vol. ii. p. 110. 1830.

(*c*) Above cited, p. 137.

(*d*) Gazette Médicale, vol. viii. p. 59. 1840. No. 4.

(*e*) Trousseau; in same. No. 36.

or without fissure, if it withstand the previous treatment, is, to cut into the edge of the *anus*, either at the seat of the fissure or at any other part. The patient should take a mild purgative three days before, and on the morning of the operation a clyster to empty the bowel, and to avoid the necessity of going to stool for some days. He should be laid upon his side, as in the operation for *fistula in ano*, the forefinger of the left hand, oiled, passed into the *rectum*, and a narrow, button-ended bistoury introduced flat upon it, the edge of which being turned to the side on which the fissure is, cuts through with a stroke the intestinal membranes, the *sphincter* muscle, the cellular tissue, and common teguments, forming a triangular wound, the apex of which corresponds to the cavity of the bowel, and its base to the external skin; sometimes a lengthening of the latter is requisite, which must be done with a second stroke of the bistoury. If, by the escape of the bowel from the edge of the knife, the wound in the cellular tissue be higher than in the intestinal membranes, the latter must be further divided with the knife or with blunt-pointed scissors. In very violent contraction of the *anus*, two cuts may be thus made, one on each side, and if the fissure be before or behind, it is not to be included in the cut. The success of this operation is often very surprising.

1625. The dressing consists of a pretty thick plug of lint between the edges of the wound, upon which some wadding and an oblong pad should be applied, and the whole fastened with a T bandage. Bleeding but rarely occurs, and is easily stopped by a slight pressure. After three or four days, the first dressing is to be removed, and replaced daily till the cure is completed, which happens in about four or six weeks. WALTHER rejects the introduction of lint and the like as useless and painful.

Upon this subject, see further,

DELPECH, Précis Elémentaire, vol. i. p. 598.

BOYER; in Journal complémentaire du Dict. des Sciences Méd. Nov., 1818.

BAILLIE, MATTH., M.D.; in Med. Trans. of College of Physicians of London, vol. v. p. 136.

GAITSKELL; in London Med. Repository, vol. iv. p. 51.

BLACKETT; in same, vol. vii. p. 377.

BOYER, Traité des Malad. Chir., vol. x. p. 125.

BASEDOW, Ueber die Strictura Ani spastica; in VON GRAEFE und VON WALTHER'S Journ., vol. vii. p. 125.

NEVERMANN, Ueber die Fissur des Afters oder die Strictura Ani spastica; in HOLCHER'S hannoverischen Annalen, vol. i. p. 729.

1626. The *narrowing of the rectum, depending on chronic inflammation and incipient degeneration of its mucous membrane*, is always of slow production. At first there is a troublesome itching in the bowel, and a secretion of muco-purulent fluid. By degrees the patient is attacked with frequent inclination to go to stool, when he strains much and passes only hard motions, of thinner size than usual: there is a sensation of fulness in the course of the *colon*, but especially in the region of the sigmoid flexure; going to stool becomes more painful and difficult, digestion fails, frequent belchings occur, with occasional severe colic; the collection of stool is often so great that the belly becomes swollen, and inflammation ensues. Frequently, if the narrow part be high up, and the bowel below have lost its expulsive power, the stools squeeze through the stricture in little pieces, collect beneath it, and are discharged in the ordinary sized masses. If *diarrhœa* occur, the patient usually feels more easy. In rare cases there is *diarrhœa* throughout the whole course of the disease; these are of the worst kind, as ulceration is going on simultaneously in the upper part of the intestinal canal.

1627. The disease proceeds more or less quickly according to the difference of constitution; the general health is sometimes affected early, sometimes remains for a long while undisturbed. As the narrowing increases, the costiveness becomes greater, the belly harder and fuller; the digestion becomes more affected, the colic more frequent and severe, and the feet swell. From the continuing costivenesss, fæculent vomiting, as well as quickly fatal inflammation of the belly, or perforation of the intestine above the stricture, may ensue, especially if kernels or other foreign bodies remain sticking in the stricture, and completely close it. If there be perforation, it usually occurs close to the stricture, at one part softened by inflammation, at which the stools are rarely poured forth into the cavity of the *peritonæum*, but rather into the cellular tissues surrounding the *rectum*, and gangrenous abscesses form around the *anus* and on different parts of the buttocks. When these burst, or are opened, a quantity of fœtid ichor and motion burst forth, a large part of the coverings becomes gangrenous, and the patient dies quickly, or *fistulæ* form, and the person may live some time in a lamentable condition.

The stricture may run on to ulceration; severe pain, ichorous discharge, and even bleeding then occur; all assume a carcinomatous character; the destruction attacks the neighbouring parts, *fistulæ* form, the skin about the *anus* and on the buttocks, the urinary bladder, the *vagina*, and womb, are attacked with ulceration; and when the destruction has extended far, the stools cannot be retained, but pass involuntarily, and the patient dies exhausted.

[" In some instances," Brodie states, " the patient dies with symptoms of strangulated *hernia;* that is, a piece of hard *fæces* is lodged above the stricture and cannot pass through it; thus there is a mechanical obstruction to the passage of the *fæces;* the belly becomes tympanitic, the tongue dry; there is sickness, vomiting, and the other symptoms indicating strangulation. He may have one of these attacks, and by means of injections and the use of a bougie, may recover; he may have a second, and recover from that; and then he may have a third, which may prove fatal." (p. 28.)

Astley Cooper (*a*) used to relate the case of a woman who, labouring under stricture of the *rectum*, was obstinately costive. On examination, a plum-stone was found to have lodged just above the stricture; it was removed with stone-forceps, and she recovered.]

1628. By the chronic inflammation, which causes stricture of the *rectum*, the mucous membrane, the cellular tissue beneath it, and afterwards all the other membranes, are thickened, till at last the whole gut is affected. The changes which the inflammation produces, are either its conversion into a hard, fibrous, even cartilaginous tissue (1) or into scirrhous degeneration, or into ulceration, with or without fibrous, cartilaginous, scirrhous, or œdematous degeneration, or into the formation of fungous loosenings, sarcomatous excrescences (2), or into shrivelling and contraction of all the parts at once, so that this part of the gut is diminished to the size of a quill, and its cavity often completely disappears.

[(1) Brodie says:—" On dissecting a simple stricture of the *rectum*, I have found the mucous membrane thickened, of a harder structure than natural, and the muscular tunic thickened also. The stricture sometimes occupies the whole length of the gut,

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(*a*) MS. Lectures.

for some way up, above the *anus*, perhaps three or four inches; at other times it is only of short extent." (p. 28.)

(2) This, I presume, is the condition to which LAWRENCE (*a*) refers, where he speaks of "another form of disease, (stricture of the *rectum*,) in which the mucous membrane seems to be formed into a large, spongy, soft, excrescence, in which the patient was affected with all the symptoms that would be produced by stricture; for this spongy state of the membrane diminished the dimensions of the bowel." (p. 855).—J. F. S.]

1629. These changes have either a less or a greater extent; commonly, they are circular, and the narrowing is so considerable, that an aperture, not larger than a straw, alone remains; often they occur only at one side or on the edge of the *valvulæ conniventes*, in consequence of which cord or bridge-like contractions, single, cone-like growths are produced. These growths, of different size, attached with narrow necks or by a broad base, soft, hard, spherical, oval, single, and vegetating sparingly, or growing luxuriantly, collected in wide or thick groups, are often confined to the edge of the *rectum*, or spread over the whole extent of the cavity of the *rectum*, or even extend into the *colon*. Although at first insensible, they grow, become painful, and terminate in cancerous ulceration, as already described. The distinction between these excrescences and the hard, hæmorrhoidal knots consists specially in their yellowish red colour, their smooth-skinned, even, tense surface exhibiting not the slightest trace of blood-vessel, in their regular, firm, in some degree elastic consistence, in the absence of all fluctuation, and in their complete insensibility on great pressure. The various form and condition of these hardenings depend on the seat, extent, and character of the inflammation and irritation.

See further on this subject,

DESSAULT, Squirrhosités du Rectum, in his Œuvres Chir., vol. ii. p. 422.

SCHREGER, Ueber tuberculöse Excrescenze; in his Chirurg. Versuchen, vol. i. p. 258.

TANCHOU, above cited.

1630. Stricture of the *rectum*, from the above-mentioned changes of its membranes, may happen at all parts of the bowel, but most frequently in the region of the internal *sphincter*, about two or three inches above the *anus*. The knowledge of stricture of the *rectum*, its seat, nature, and form, is simply and alone to be obtained by examination. On the introduction of the finger, oiled, a narrow, hard, unyielding part is felt, either as one or several little, projecting folds or partitions, into the opening of which the finger can be introduced only with difficulty or pain, or not at all; or as a hardening and contraction of the walls of the gut to a great extent; or as ulceration, with hard edges; or as tumours of various form. The examination should be always made in the recumbent posture, because the valve-like narrowings at the upper part of the gut, which mostly are seated on its front, form a sort of pouch in front, and above the narrowed part, which, when the patient stands upright, prevents the examining finger discovering the stricture. If the narrowing be so high that the finger cannot reach it, the examination must be made with a wax bougie or a sound covered with modeller's wax, which, softened and oiled, should be carefully introduced into the *rectum*, and gently pressed on the seat of stricture, in order to take an impression of it. In doing this, the anatomical relations of the *rectum*, and the rules subsequently laid down for the introduction of the bougie, must be remembered, to prevent mistake, as the examination by this mode is much less certain

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(*a*) Lectures; in Lancet, vol. ii. 1829–30.

than with the finger. Particular instruments, used for examining strictures of the *rectum*, a stem with a ball, as recommended by Howship and Calvert, are to be set aside, if the finger can reach the stricture. When the symptoms lead to the supposition of stricture of the *rectum*, the examination should always be made as soon as possible, in order to discover the disease in its earliest stage of development.

[Lawrence (*a*) observes:—"We cannot, however be certain that stricture of the *rectum* is the cause of any of the symptoms under which a patient labours. unless we have the power of *feeling* the contracted part of the gut with the finger, or of ascertaining its existence by an instrument, a *rectum* bougie, introduced there: and indeed we can hardly get clear evidence of the fact, when stricture is higher up in the bowel than we can reach with the finger; for you will recollect that the course of the *rectum* is by no means straight, and the surface of the intestine is not smooth and uniform; in its natural state there are folds and irregularities which present obstacles to the passage of an instrument along it. * * * In all instances, therefore, when the disease of the bowel is situated higher up than you can reach with the finger, the evidence is more or less uncertain, unless the difficulties in the evacuation of the *fæces*, or the peculiar configuration and diminished size of them should be well marked." (p. 856.)

Bushe (*b*) remarks, that "organic stricture (of the *rectum*) is supposed by many to be of very common occurrence, but I have not found it to be so; for the cases I have seen bore no proportion to the number I ought to have met with, were the statements made in books correct." (p. 264.)

There has been much said and written as to the usual seat of stricture of the *rectum*; it has been said to be most common about the termination of the *colon* (White) (*c*), or five or six inches from the *anus*, and next in frequency at the junction of the sigmoid flexure of the *colon* with the *rectum*. (Salmon) (*d*). These, however, must be very rare cases, for all the best authorities declare the stricture to be almost universally low down. Charles Bell (*e*) says:—"Not unfrequently, the inner edge of the deep *sphincter ani* being the seat of this stricture; and then the finger only enters to the depth of the second joint, when it is obstructed by a sort of membrane standing across the passage. Sometimes the stricture is more than two inches within the *anus*, and feels like a perforated *septum*." (p. 330.) Colles (*f*) says:—"In a few instances the stricture has been seated so high up in the gut, that it could be but barely touched with the point of the finger, until the patient was desired "to force down," and then a satisfactory examination of it could be made." (p. 139.) According to Allan (*g*), "stricture of the rectum most commonly occurs near the termination of the gut, a little within the *sphincter*, but it may take place in any part of the *rectum*, sometimes the whole gut is lessened in diameter, and on other occasions the stricture is situated in the sigmoid flexure of the *colon*." (p. 488.) Liston (*h*) speaks of it as "readily ascertained by examination with the finger." (p. 73.) And Syme (*i*) that "it is generally found at about two and a half or three inches distant from the orifice, but may be situated much higher up." (p. 445.) Brodie (*k*), in speaking of these strictures, says they "are commonly situated in the lower part of the gut, within the reach of the finger. Are they ever situated higher up? I saw one case where stricture of the *rectum* was about six inches above the *anus*, and I saw another where there was stricture in the sigmoid flexure of the *colon*, and manifestly the consequence of a contracted cicatrix of an ulcer which had formerly existed at this part. Every now and then, also, I have heard from medical practitioners of my acquaintance of a stricture of the upper portion of the *rectum*, or of the sigmoid flexure of the *colon*, having been discovered after death. *Such cases, however, you may be assured, are of very rare occurrence.* Inquire of anatomists who have been for many years teachers in the dissecting-room, or of Surgeons who have witnessed a great number of examinations in the dead-house of an hospital, and they will bear testimony to the correctness of what I have now stated. Nevertheless, an opinion has of late years prevailed among some members of our profession, that a stricture high up in the *rectum* is a very frequent cause of constipation of the bowels; and I have known an almost incredible number of persons who have been treated on the supposition of their labouring

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(*a*) Lectures in Lancet, 1829–30, vol. ii.

(*b*) Cited at head of article.

(*c*) Observations on Strictures of the Rectum. Bath, 1820. Third Edition.

(*d*) Cited at head of article.

(*e*) On the Diseases of the Urethra, Vesica Urinaica, Prostate and Rectum. London, 1822.

(*f*) Dublin Hospital Reports, vol. v.

(*g*) A System of Pathological and Operative Surgery, vol. iii. Edinburgh, 1824.

(*h*) Elements of Surgery. London, 1832. 8vo.

(*i*) Principles of Surgery. Edinburgh, 1832. 8vo.

(*k*) Above cited.

under such a disease, by the introduction of long bougies into the bowel. The only evidence of the existence of a stricture in these cases has been, *first*, that there was obstinate costiveness; *secondly*, that a bougie introduced into the *rectum* could not be made to pass beyond a certain number of inches beyond the *anus*. But what is the value of this evidence compared with that which anatomy affords of the rarity of this kind of stricture? Are there not many causes of a costive state of the bowels, besides mechanical obstruction? Will it be always easy, even in the most healthy *rectum*, to introduce a bougie more than a few inches into it? Although we call the lower bowel the *rectum*, you know very well that it is anything but a straight gut. Three or four inches above the *anus*, the *rectum* begins to make flexures, which increase as you trace it upwards, until they terminate in the sigmoid flexure of the *colon*. These flexures of the *rectum* differ in different individuals, and even in the same individual, at different periods. When a bougie is introduced, be it small or large, it is certain that it will be stopped somewhere or another by one of these flexures; and nothing can be more unphilosophical than to conclude, because a bougie meets with an impediment at the distance of five or six, or eight or nine inches, that this is the result of an organic disease of the *rectum*, when the natural formation of the parts will sufficiently account for it. But let us suppose that you actually meet with one of those rare cases in which there is a stricture in the upper part of the *rectum*; by what means are you to recognise the disease in a living person? Or if you can recognise it, how can you know its exact situation? If the bougie can only be introduced to a certain distance, how are you to be certain that it is stopped by the stricture, and not by a fold of the bowel, or even by coming in contact with the *sacrum*? Further than this, if you employ the force which you would suppose to be necessary to make the bougie penetrate through the stricture, is there no danger of penetrating the tunics of the intestine instead? This last is no theoretical objection to the use of these long bougies in diseases of those parts. I will not say that I have seen the patients; but I have been informed on good authority, of not less than seven or eight cases in which this frightful accident occurred, and the patients died in consequence." (p. 30.) Lastly, Bushe states:—"Independently of the malignant forms of disease hereafter to be described, I have very seldom seen a contraction of the *rectum* which was not within the reach of the finger." (p. 265.) I am afraid that the conclusion of one of his notes is not without its parallel in this country, and ought to be held up to the reproof it richly deserves. "I am mortified to add," says he, "that I have good reason for supposing there are a few who make a profitable trade of treating dyspeptic patients for stricture of the *rectum*, asserting that the obstruction is high up, when in truth, this intestine is perfectly free from structural disease. Such practitioners, by passing bougies, apparently cure, what in reality never existed, and thus obtain a character for skill in the treatment of this disease, which in truth they do not possess."—(p. 266.)

1631. The immediate cause of stricture of the *rectum* is always a more or less extensive inflammation or continual irritation of the *rectum*, in consequence of which there is secretion of plastic matter, thickening and degeneration of the tissue. The *causes* are, hæmorrhoidal affections and abdominal *plethora*, anomalous gout, *syphilis*, metastasis of skin diseases, suppression of the usual discharges, frequent indigestion, badly treated irritation of the intestinal canal, *diarrhœa*, improper use of irritating purgatives, constant costiveness, injury of the *rectum* by foreign bodies, extirpation of hæmorrhoidal knots, operation for *fistula in ano*, and pædarasty, as I have witnessed in two instances.

1632. The *prognosis* differs according to the degree, condition, seat, and cause of the stricture. Membranous, circular, and strictures unattended with ulceration, if not seated high up, lead to a favourable *prognosis*. If the disease be more advanced, the stricture accompanied with much hardening, seated high up, and its causes cannot be removed, the *prognosis* is unfavourable; perhaps by cautious treatment temporary relief may be obtained, but never a perfect cure. If the stricture have run on to ulceration, the patient, generally, can scarcely obtain relief, and any treatment not especially cautious, renders him worse, and hastens the evil results. The same happens in carcinomatous degeneration.

[BRODIE observes, that "success in the management of this disease will vary very much in different cases. It will depend chiefly on the period of the disease on which you are consulted. If it be quite in the early stage, you may render the patient great service; and although you cannot cure the stricture of the *rectum*, any more than you can cure the stricture of the *urethra*, yet you can dilate it, and keep it dilated, so that the patient will suffer little from it, and that it will not shorten his life. But if you are consulted in the advanced stage, when the stricture is much contracted, when the mucous membrane is ulcerated, when abscesses have formed in the neighbourhood, you can only palliate the symptoms in some degree. The patient under the circumstances, in spite of all your efforts, will lead a a miserable life, and in all probability will ultimately fall a victim to the disease." (p. 30.)]

1633. The *treatment* of stricture of the *rectum* consists in subduing its cause and the constitutional disease in causal relation to it, and in the removal of the stricture. The first indication requires the use of suitable antiphlogistic remedies, or such as operate on the skin, purging, proper treatment of hæmorrhoidal affections and abdominal *plethora*, and so on; but especially strict attention to the mode of living, carefulness as to free relief from the bowels, repeated application of leeches, soothing injections into the *rectum*, hip-bath, rubbing in mild ointments with, according to circumstances, extract of *belladonna* or *cicuta*. By such treatment, with proper care, and corresponding to the circumstances of the individual case, a stop may be put to an incipient stricture, as I have in some instances observed. I have also used at the same time, internally, iodide ot potash with good effect. But such result is only possible in the very beginning of a stricture; if it have already proceeded farther, no effect can be produced on the stricture itself, but it is necessary, if the stricture and the *rectum* be in a state of irritation, to undertake in addition the direct employment of mechanical remedies upon the stricture, which consist of *stretching*, *cutting into* or *cutting out*, and *cauterization* of the stricture.

[" In some cases," says BRODIE, " the *fæces* accumulate above the stricture, the bowel, in this situation, becoming distended into a large bag, forming an immense reservoir of fæculent matter, always pressing against the stricture, and aggravating the disease. It is very important to empty the bowel which is thus loaded; and you can only do it in the following manner :--Introduce an elastic gum catheter through the stricture into the fæculent mass above; inject tepid water, or tepid soap and water, or a weak solution of caustic alkali; and by repeating this operation, and washing out the gut with warm water every day, or every other day, you may at last get the whole of the fæculent accumulation dissolved, and empty the reservoir. When this has been accomplished, the injection of warm water should be constantly repeated, so as to prevent the accumulation taking place again." (pp. 29, 30.)]

1634. *Stretching*, by which the narrowed part may be enlarged, and the consolidation of the cellular tissue accompanying it overcome, is effected, with plugs, wax, and elastic bougies, sponge tent, with metallic, linen, or goldbeater's skin dilators, and the like.

1635. The plugs of lint which DESAULT used with the especial object of introducing medicated substances, are carefully passed into the stricture with a plug-holder, after having been smeared with mild ointment, to which extract of *belladonna*, or *cicuta* have been added; or an injection of decoction of *cicuta* is made. The plugs should be made thicker, and allowed to remain up for a longer time, according as the patient can bear them. As their introduction with the holder is often difficult, and the plug completely closes the *rectum*, so as even to prevent the escape of air, TANCHOU has proposed fixing the plug on an elastic metal canula, and to introduce it on a silver button-ended probe, first passed into the stricture.

1636. Elastic and wax bougies, of corresponding size, are introduced into the stricture. Properly prepared wax bougies, of from one to three and half inches in circumference (SALMON) are the best. In introducing these bougies the following rules are to be observed, according to the different heights at which the stricture is situated. The bougie, curved according to the curvature of the *rectum*, and well oiled, with the convexity corresponding with the first curve of the gut, and directed towards the *sacrum*, is thrust in upwards and backwards, in this direction, to the extent of two inches. After a little waiting, the bougie is introduced still higher, from three to three and a half inches above the second curve of the *rectum;* the inner extremity of the bougie still remains in the hollow of the *sacrum*, and the outer end is inclined to the left side. If the bougie be introduced still further, its direction must be changed, the outer end being raised from left to right in a semi-circle, and pushed forwards at the same time, and in this manner it may be introduced yet four inches further. If the instrument have to be passed into the sigmoid flexure its outer end must be pressed gently down, and pushed upwards, till it be completely carried in. The deeper the instrument is introduced the more care must be taken, lest dangerous irritation, or even perforation, of the sigmoid flexure should occur. There is, commonly, pain over the whole belly, and violent forcing. The contraction of the *sphincter* causes the most difficulty; the bougie, therefore, of different length, according to the seat of stricture, is to be well passed into the *rectum*, and there retained by means of a bandage attached to it. The patient should keep quiet in bed, and the bougie allowed to remain in, not longer than from six to ten minutes, nor so long, if the patient complain of severe pain. Its introduction is to be repeated every two or three days, its size increased, as also the time it should remain, according to the patient's irritability, but every violent irritation should be carefully avoided. I have used elastic bougies with a dilator, as in narrowings of the *œsophagus*, (*par.* 1606,) which I once introduced into a stricture, and repeated every two days, as dilatation, continued, for some time, easily sets up considerable iritation, and even becomes unmanageable. In strictures, situated high up in the *rectum*, the elastic or wax bougies are the only remedies which can be employed.

[BRODIE observes:—"In a great number of cases, where the disease is far advanced, you cannot resort to the use of the bougie in the first instance, or, if you do, it must be employed in combination with other remedies. It will be necessary to lessen the irritability of the bowel by the introduction of an opiate suppository every night, and a gentle aperient taken in the morning. The patient may take a combination of caustic potash with copaiba; half a dram of balsam of copaiba, fifteen minims of *liq. potass.* three drams of mucilage of gum arabic, and about nine drams of carraway water. A draught of this composition may be taken three times a-day with very great advantage. BRYANT, of Edgeware-road, recommended to me a decoction of *Achillea millefolium*, which I have employed in some of these cases with manifest advantage. About two ounces of the *Achillea* may be put into a pint and a half of water and boiled down to a pint, of which the patient may take a wine-glass full three times a-day." (p. 29.)

With regard to the use of bougies in stricture of the *rectum*, LAWRENCE says:—"It is a question how far the stricture can be relieved by the introduction of bougies. When the stricture is situated so near to the *anus* that you can examine it with your finger, and when you can, therefore, ascertain with considerable certainty something of the state of the bowel, when you can ascertain, by such means, how far the mechanical irritation of dilatation will be borne, you may cautiously use bougies, as in the case of stricture of the *urethra*, but you must employ them under the same kind of restrictions and cautions as in that case. Indeed, you may find it necessary to be even more cautious in the case of the *rectum* than in that of the *urethra*, inasmuch as you are so much uncertain, when you meet with a difficulty, whether you are pressing against strictured or sound parts of the gut. You must employ instruments which will not be likely to injure the bowel.

Very commonly you find instruments of elastic gum recommended for this purpose, which have the advantage of being sufficiently smooth, but they do not readily accommodate themselves to the course of the canal: I do not consider them eligible instruments. Therefore you had better use *rectum* bougies, made of a soft composition; and, I consider, indeed, that the common plaster bougies, used for the *urethra*, are not of a sufficiently soft substance for a *rectum* bougie. There are *rectum* bougies, made for the purpose, of a composition so soft, that if you dip them into tepid water, they will be immediately softened, and very well adapted for the purpose. These are what I would recommend; and you should never employ any force." (p. 856.)

"In some cases of stricture of the *rectum*," Brodie says, "I have thought that the patient has derived benefit from the application of mercurial ointment to the inside of the gut, which is easily managed in the following manner. Let the bougie be covered with lint smeared with mercurial ointment; the bougie, thus anointed, must be allowed to remain in the stricture for a few minutes daily." (p. 30.)]

1637. For the purpose of increasing the extension at pleasure, and to operate specially upon the narrowed part, peculiar dilators have been proposed by Arnott, Bermond, and Costallat. Arnott, as well as Charles Bell, introduces a piece of prepared gut, by means of a sound, into the stricture; the distension of the former is effected by blowing in air, and of the latter by injecting water. Bermond's (*a*) and Costallat's (*b*) apparatus consists of a little bag of linen or gold beater's skin, introduced into the stricture, and by filling it with lint, extension can be made specially at the seat of the stricture. The constant distension purposed by these apparatus easily excites violent irritation and pain which is unbearable.

1638. In the dilatation by metallic means, as the dilators recommended by Weiss and Charriere, for which also Astley Cooper employed a pair of narrow forceps, the distension is effected gradually, and repeated in a few days. Astley Cooper (*c*) in this way established the calibre of the bowel in course of a few weeks, in two instances. Dilatation with metallic instruments can only be employed in valvular and recent strictures which are not complicated with hardening or inflammation.

1639. Cutting into the narrowed part, generally objected to by many Surgeons, can be employed only in valvular or circular strictures which can be reached with the finger, and are unconnected with inflammation, hardening, or hypertrophy. In hardening, and in carcinomatous degeneration it always produces bad symptoms. A button-ended bistoury is to be carried in upon the introduced finger of the left hand, or upon a director, and the bridges divided with it, or several notches made in the stricture, at proper distances apart from each other or at the most projecting part. If possible these cuts should be made towards the *sacrum*, and always with care not to extend beyond the bounds of the disease, nor to cut open the walls of the bowel itself.

Wiseman (*d*) first made use of such cuts in stricture of the *rectum*.

Copeland (*e*) says:—"In the indurated annular stricture, which has for a long time resisted the introduction or the enlargement of the bougie, I have more than once introduced a probe-pointed curved bistoury, and divided the thickened parts, on that side of the *rectum* which is contiguous to the *sacrum*; and I have frequently seen the late Mr. Ford perform the same operation. Wiseman divided a contracted gut three or four times in the same person; his case, however, was not one of idiopathic stricture, but was produced by the rude operation for *fistula in ano*, which was practised at that time." (p. 32.)

(*a*) Thèse, 1827.—Velpeau, Elémens de Méd. Opér., vol. ii. p. 988.—Froriep's Chir. Kupf. pl. 330.

(*b*) Essai sur un nouveau mode de Dilatation particulièrement appliqué aux rétrécissemens du Rectum. Paris, 1834.—Froriep, just cited.

(*c*) Tanchou, above cited.

(*d*) Several Chirurgical Treatises, p. 239. London, 1676. fol.

(*e*) Above cited.

[Brodie recommends the division of the stricture, in the following manner :—"Introduce a *bistouri caché*, and let the screw be so adjusted that the blade may be opened about the sixth of an inch, but certainly not more than a quarter of an inch. The bistouri must be introduced with the blade shut; then press on the handle, open the blade, and drawing it out, you nick the stricture first in one part of its diameter, then in another, and then in a third. This being done, a larger bougie may be introduced than could be done before, and the cure is very much expedited." (p. 29.)]

1640. Extirpation can only be employed in narrowings of the *rectum* dependent on tuberculous excrescences, when situated at the edge or in the lower part of the *rectum*, from whence they may be drawn forth, or protruded by straining at the anal aperture, and being held with forceps or by a thread passed through them, may be removed from their base with knife or scissors without danger. Schreger, from experience, prefers extirpation in such cases, although it had been objected to by Desault. If the excrescences be seated higher, extirpation can only be performed under certain conditions as to their form, that is, when they are provided with a neck. No important symptoms follow this operation, as the absence of vessels in these excrescences and their insensibility prevent bleeding, and sympathetic affection of the *rectum*, and the internal coat readily shoots over. If the excrescences be situated higher than we can venture without danger to extirpate them, the removal of those nearest the anal orifice will, however, relieve the patient's condition; the application of pressure sufficient to efface those above facilitates, and considerably shortens the cure.

Compare Rognetta (*a*) in reference to those warts of the *rectum*, which in their tissue precisely resemble warts on the skin, and must be removed though they frequently return.

1641. Cauterization with a bougie armed with lunar caustic has been employed by Home (*b*) in ring-shaped stricture of the *rectum*, and cauterization with dilatation by Sanson, in three cases, though without particular effect. (Tanchou.) Sanson has recommended a caustic-holder similar to that of Ducamp; Tanchou employs an elastic catheter, opened at the side, into which he introduces a second fitted with caustic. Cauterization must always be considered a very uncertain mode of treatment: it can only be of use when properly performed, and the dilatation is sustained (*c*).

1642. If, in the course of this disease, fistulæ form about the *rectum*, the treatment must first be directed towards the stricture, and when that is got rid of, the fistula may be treated in the usual manner.

If the disease be cancerous, alleviation only can, in most cases, be obtained by thin plugs, smeared with softening and soothing ointments, by injections of decoction of *cicuta*, suppositories of *hyoscyamus*, *belladonna*, and the like. But, if the disease be seated at the lower part of the *rectum*, if its upper boundary can be reached with the finger, if the cellular tissue surrounding the lower part of the gut be healthy, the bowel movable and permitting its drawing down, the extirpation of the cancerous part, according to Lisfranc's (*d*) proposal, may be undertaken.

1643. The patient being placed as in the operation for the stone, two semi-circular cuts should be made about an inch in front of the *anus*, which, dividing the parts to the cellular tissue, should meet behind. The intestine is then to be dissected from its connexions till it is completely

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(*a*) Gazette Médicale, vol. iv. p. 387. 1836.

(*b*) Practical Observations on the Treatment of Strictures of the Urethra, &c., vol. ii. p. 418.

(*c*) Tanchou, above cited, p. 182.

(*d*) Revue Medicale, vol. iii. 1830, p. 471.

set free all round. The forefinger, half bent, is now to be introduced into the gut, and sufficiently drawn down to make the mucous membrane protrude, so that a portion of it can be easily removed with curved scissors, or with the knife. If the cancer affect the whole thickness of the intestinal wall, and do not extend more than an inch upwards, the whole gut must be everted, and the entire disease laid bare. The everted part is then to be cut into, parallel to the axis of the trunk, and cut off with the curved scissors. Should the cancer have affected all the membranes of the intestine and the neighbouring cellular tissue, then after the first two cuts have been made, and the lower part dissected, a cut must be made with a pair of straight scissors upon the introduced forefinger, through the whole wall of the intestine backwards, where few vessels and the *peritonæum* can be wounded, and which has also the preference of rolling out the gut and laying bare the disease at the same time, after which it is to be removed with scissors in the sound part. In operating on men, a catheter must be kept in the bladder, to prevent injury to it. The bleeding vessels must, as far as possible, be tied, or sponge dipped in cold water, or a sufficiently thick bundle of lint introduced. If the bowel have been plugged, the plug must, after some hours, be renewed. For the purpose of preventing the narrowing of the gut whilst the scar is forming, a pretty large bundle of lint must be introduced, and there kept, during suppuration, for a month.

This operation is more difficult in the female than in the male, and an assistant must keep his finger in the *vagina* to prevent its injury, whilst the operation proceeds. In the female, after an oval cut is made, distant about three quarters of an inch from the opening of the *rectum*, and continued to the gut, the *rectum* must be gently pulled, and two inches of its side and hind part removed, without injuring the *vagina*. The projection which the *rectum* forms in front is about sixteen lines, on account of the connexions it has with the *vagina*, which, formed of an aponeurotic tissue, and very thick cellular tissue, stretches through the muscular fibres from the fatty tissue beneath the skin, at a depth of three lines. When, in the female, the *rectum* is dissected up to the attachment of the *peritonæum*, and drawn by means of a pair of forceps, there is a space of six inches forwards, and aside between the lower end of the bowel and the *peritonæum*, but behind we may proceed still higher, on account of the *meso-rectum*. In the male, the distance from the *anus* to the *peritonæum* is about four inches.

1644. When the narrowing depends on a large scar, nothing more can be done than to cut deeply into it at several places, and to widen the anal aperture by the introduction of plugs, lint, or sponge. In the narrowing of the *rectum* by tumours in its neighbourhood, which impress it, the *prognosis* and treatment are guided by their situation and condition.

A narrowing of the *anus* by growing together of the buttocks, as the consequence of badly treated ulceration, so that the motions are only as thick as a feather stem, and for the most part involuntary, Rust (*a*) cures completely by division of the united buttocks.

1645. If narrowing of the *rectum* run on to closure, and *ileus* be produced, the formation of an artificial *anus* is required, although always a very doubtful remedy (*par.* 1616.)

IX.—OF GROWING TOGETHER AND UNNATURAL CLOSURE OF THE PREPUCE.

Petit, J. L., Traité des Maladies Chirurgicales et des Opérations qui leur conviennent, vol. ii. p. 421.

Zier, Dissertatio de Phimosi et Paraphimosi. Jena, 1785.

(*a*) Magazin, vol. i. p. 237.

MÜLLER, De Phimosi et Paraphimosi earumque curatione. Erf., 1797.

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KIRNBERGER, THEOD., Historisch-kritische und pathologisch-therapeutische Abhandlung über die Phimosis und Paraphimosis. Mainz, 1834. 4to.

COLLIN, Die Beschneidung der Israeeliten. Dresden, 1812.

TERQUEM, Guide de Posthetomiste, avec un exposé d'un nouveau procédé. Metz, 1843.

BERGSON, J., Die Beschneidung vom historichen, kritischen und medicinischen Standpünkte. Berlin, 1844. With a plate.

1646. The unnatural narrowing of the prepuce, so that it cannot be readily retracted over the *glans penis*, is called *Phimosis;* and if the very narrow prepuce which has been retracted cannot be again brought forward, it is named *Paraphimosis.*

1647. *Phimosis* is either a vice of the first formation, and congenital, or it may be accidental, from inflammation of the *glans* and prepuce; in which latter case it is named by some *complicated phimosis*, in opposition to the first form.

1648. The prepuce, in children, has generally so narrow an aperture, that it cannot be retracted over the *glans;* and peculiar symptoms may occur if this aperture be very narrow or entirely closed. When, for example, the orifice of the prepuce is smaller than that of the *urethra*, the urine cannot flow in its usual stream, part of it collects under the prepuce, distends it, and can only be completely voided by pressure. By the urine thus retained, and becoming putrid, the prepuce is inflamed, often lengthens and becomes hard; and even stony concretions may be formed between the *glans* and the prepuce. If the prepuce have not an opening, it becomes distended by the collecting urine to an oval transparent swelling, and the retention of urine may be fatal, if assistance be not afforded in proper time.

1649. If the congenital narrowing of the prepuce be not so great as to produce the just mentioned symptoms, it is rarely noticed before puberty. If the erections of the *penis* then occurring be not sufficient, by degrees, to enlarge the aperture of the prepuce, so that it can be easily retracted over the *glans*, which depends on the great length of the prepuce or the shortness of the *frænum* connecting the prepuce and *glans*, or it may be on the imperfect development of the *penis* itself, erection and connexion will be painful; inflammation, excoriation, and so on, will be produced by the obstructed flow of the urine, and by the collection and putrifying of the cheeselike matter beneath the prepuce; and also the proper ejection of the *semen* will be prevented by a very small orifice of the prepuce.

1650. *Accidental phimosis* arises from inflammation, in which, as consequence of swelling of the prepuce, its aperture contracts, and, as consequence of increased determination of blood, the *glans* itself enlarges. Usually, those persons are attacked with accidental *phimosis* who have, from birth, a very long and narrow prepuce. The special causes may be, venereal ulcers, when seated on the edge of the prepuce, upon the *corona glandis*, or on the *frænum*, internal or external *gonorrhœa*, warty excrescences, and excoriation of the prepuce from putrescence of the cheese-like matter retained beneath it, or from any other irritant. The inflammation is either acute or of an erysipelatous kind; often is the prepuce swollen with *œdema*. *Phimosis* may also be produced by any chronic swelling and thickening of the prepuce, as in hardening, in scirrhous or any other degeneration.

1651. The symptoms caused by such *phimosis* vary according to its degree and its cause. In venereal ulcers upon the *corona glandis*, if the pus be retained, the prepuce may be gradually eaten through, and the whole *glans* often protrudes through the hole. The inflammation may run on to gangrene, which is particularly to be feared in adults, and if mercury have been previously and frequently used; the urine collected beneath the prepuce may cause excoriation, may be effused into the cellular tissue of the whole *penis*, and producing gangrene, cause its destruction. The swelling may even be so great that the *glans* and *urethra* may be partially compressed. If the inflammatory stage pass by, a chronic *phimosis* may remain, in which there is a hard, cartilaginous swelling of the prepuce, or growing together of the prepuce and *glans*. Should the obstruction to the voidance of the urine by the narrowness of the prepuce, affect the bladder and *urethra*, distension, weakness, and even palsy of those parts may be produced.

1652. The *treatment* of *phimosis* consists in removing the narrowing by operation; or in *phimosis*, accompanied with inflammation, by remedies capable of diminishing the swelling of the prepuce and *glans*. In children this operation is only called for when there is complete closure of the prepuce, or the congenital *phimosis* is to such degree that it prevents the discharge of the urine, and in adults, when, besides the voidance of the urine, the discharge of the *semen* is also stopped, connexion painful, or if the orifice of the prepuce have a cartilaginous ring.

If the narrowing of the prepuce be only slight, softening rubbings-in, bathing, and repeated daily attempts to retract the prepuce, are sufficient to widen its orifice (*a*). Particular instruments have been also used for this purpose (*b*). This practice is, however, always tedious, painful, and can only in a few cases be effective.

1653. The two usual modes of operating for *phimosis* are *circumcision* and *slitting up the prepuce*, with or without removal of the flaps. If a congenital *phimosis* be distended by collection of the urine, it is sufficient to thrust in a lancet at the under and fore part of the prepuce, without injuring the *glans*, and then, after every discharge of urine, to insert a little plug into the aperture for a time.

1654. Circumcision (*Circumcisio*, Lat.; *Beschneidung*, Germ.; *Circoncision*, Fr.) consists in the operator taking hold of the prepuce, above and below, with the thumb and forefinger of the left hand, so that their tips are about a line distant from the *glans;* an assistant draws back the outer fold of the prepuce, as far as possible, to the root of the *penis*, or compresses the *glans* with his thumb and finger; the operator then cuts off that part of the prepuce which he holds, with a stroke of the bistoury, but cautiously, that he do not injure the *glans*. The size of the piece to be removed must depend on the length of the prepuce, and on the extent of its narrowing and thickening; too little, however, must not be removed, as, if so, the inflammation following the operation easily produces fresh narrowing. It is superfluous to hold the part to be cut off with a clamp, as recommended by some practitioners. If, as almost always happens, the outer fold of the prepuce be retracted further than the inner, the latter must also be cut off to correspond. The bleeding, which is often con-

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(*a*) Loder, above cited, p. 90.

(*b*) Heister; Instit. Chirurg., pl. xxvi. f. 5.

siderable, must be stanched with cold water, with sponge, with continued pressure, or if any single vessel spirt forth, it must be tied.

Samuel Cooper and Wattmann recommend the connexion of the two folds with stitches.

The *Jewish circumcision* differs in that after the child is wrapped from the shoulders to the *pubes* and from the middle of the thighs to the ankles in a cloth properly fastened and laid across the thighs of a sitting man, by whom he is properly held, the circumcisor grasps the prepuce with the thumb and forefinger of his left hand, draws it forwards, and inserts it in the cleft of an instrument similar to a silver spatula. Thus holding the prepuce, and raising the *penis* upright, he cuts off the former close to the plate with a single stroke of a button-ended knife. *The circumcisor now, as quickly as possible, seizes the inner fold of the prepuce with his thumb-nails, which have been specially cut for the purpose, and tears it immediately up to the corona glandis.* He then spirts some water from his mouth upon the wound, takes the *penis* in his mouth, and sucks the blood out of it a few times. A strip of fine linen is then wound round the *corona* and the cut surfaces, as a dressing, and the *penis* laid upon the *pubes*, in a ring to prevent it being touched (1).

Terquem (*a*) speaks in favour of removing the inner layer of the prepuce, and has proposed an instrument like a pair of scissors (*posthetome mobile*) for the purpose.

(1) Many years ago I was present at a Jewish circumcision, and was so much struck with its facility and appropriateness to the purpose, that I have ever since performed the operation in the same manner, except that instead of inserting the prepuce in the cleft spatula, I merely grasp it with a pair of dressing forceps, as close as possible to the *glans*, and then cut it off before them. The tearing up the inner part of the prepuce to the *corona* is a very important part of the operation, and far preferable to its division to that extent with the knife, as, whilst the inflammation is subsiding, the cut edges, especially near the angle of the wound, are prone to adhere together, by quick union; and even if this do not extend far, it causes a girthing of the *glans*, which is inconvenient and often requires a second division to complete the cure. By tearing the inner skin, which should always be torn completely behind the *corona*, or the operation will be useless, the edges of the wound become sloughy, and disposition to quick union is prevented. From repeatedly having performed circumcision in this way, I am sure it is the best mode. And I may add, that, as regards circumcision or slitting up of the prepuce, the former is in every case much to be preferred. I never, however, put in any stitches, as they are not merely superfluous, but add to the necessary inflammation without sufficient reason.—J. F. S.]

Upon the bleedings after circumcision, see Goldmann (*b*).

1655. *Slitting up the prepuce* is performed in various ways, in doing which, however, it must always be remembered that the outer fold should first be well drawn back, so that, as far as possible, an equal division of both folds should be made. Through the orifice of the prepuce is to be introduced Savigny's fistula-knife, or a knife specially for this operation (*c*), with its point guarded, and held flat, till it reach the middle of the *corona glandis;* it must then be turned on edge, and, by sinking the handle and raising the point, it is thrust through the skin, and then being drawn towards the operator, it divides the prepuce at a stroke. The flaps are to be grasped, one after the other, with the thumb and forefinger of the left hand, and cut off obliquely downwards and forwards with the curved scissors, along and close to the *frænum*, or, if they be not too large, they may be left, and gradually shrink and retract. According to Cloquet's mode (*d*), a director should be introduced at the under part of the prepuce, parallel to the *frænum*, and upon it the division made with the knife. If the *frænum* be very short, it must also be divided with the scissors. The longitudinal wound becomes transverse by the retraction of the prepuce, and heals without deformity.

(*a*) Above cited.

(*b*) von Graefe und von Walther's Journal, vol. iv. p. 284, vol. xiii. p. 201.

(*c*) Guillemeau, Benj. Bell, Petit, and Latta, have proposed particular kinds of knives for this operation.

(*d*) Bulletin des Sciences Medicales, 1826, June, p. 206.

Covering the point of a narrow bistoury with wax, for the purpose of introducing it into the aperture of the prepuce, is unnecessary. Many persons in this operation use button-ended scissors; others introduce a director up to the *corona glandis*, and upon it a narrow-pointed bistoury, which they thrust through, after withdrawing the director, and divide the prepuce as just mentioned.

If in consequence of the retraction not having been properly made, the external fold of the prepuce be insufficiently divided, it must be done with the scissors. If the narrowing of the prepuce be of that kind that slitting it up half way is sufficient, this must be done, and the flaps cut off obliquely from above downwards, or left to retract.

In order to prevent the swelling of the flaps of the prepuce, which, by sewing together, causes that of the obtuse angled wound, Fricke (*a*) makes, after the division of both folds of the prepuce as already directed, a cut of the length of half an inch through the skin to the underlying cellular tissue, towards the root of the *penis*. The division of the prepuce at the upper, middle, or under part, is always preferable to that on either side.

Sometimes the narrowing of the prepuce depends on a hard ring, situated in its inner fold; it is then sufficient to pass a narrow button-ended knife behind this ring, and to cut through it in withdrawing the knife.

1656. After the bleeding is stanched, the edges of the wound should be covered with lint, confined with sticking plaster, a small compress, and a narrow bandage, and the *penis* placed upright towards the belly. If inflammation ensue, cold applications are to be made; and in œdematous swelling and gangrene, warm ones. The dressings should be removed as often as necessary.

1657. Although circumcision of the prepuce is by many practitioners considered to have great advantages, especially when its aperture is narrowed merely by a hard ring, if the fore part of the prepuce be not only unnaturally narrow, but also thickened, relaxed, or to some extent contracted into a tube (*b*), yet by this treatment less of the inner than of the outer fold is cut off, and frequently so much less that the object of the operation is not attained, if the inner coat be not also either cut into or cut off; for which reasons the slitting up of the prepuce is, indeed, in general properly employed (*c*), and circumcision only in the simultaneous great degeneration of the prepuce, and then the inner fold must be also specially divided. It is also always most advisable to remove the flaps after slitting, as already mentioned, as they swell considerably after the operation, remain thick and misshapen, and render connexion painful, or prevent it, and only in children after the lapse of some years resume their proper size. This renders Cloquet's proposed operation superfluous.

1658. The operations in which not the whole thickness of the prepuce, but specially only its inner fold, seem preferable to those already mentioned. The origin of congenital *phimosis* is not, as usually supposed, a narrowing of the two folds of the prepuce, but merely a want of extensibility in the inner one. The operation may therefore be most simply performed in the following way. The external skin of the *penis* should be retracted sufficiently far to discover the aperture of the prepuce, into which a narrow-pointed bistoury, with its edge upwards, is to be introduced, or a pair of scissors, and some lines distant of both folds divided. With the fingers of the left hand the skin is much drawn back over the *glans*, which, thus somewhat uncovered, the slightly extensible inner fold appears tightly stretched over the *glans*, and preventing the retraction of the prepuce. This inner fold is now to be divided either with the knife or scissors, as often as is necessary, till the prepuce is quite free upon the *glans*, and capable of being brought backwards and forwards. The bleeding is of no

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(*a*) Annal. der chirurg. Abth. des Hamburger Krankenhauses, vol. ii. 256.

(*b*) Loder, above cited, p. 86.—Richter, Anfangsgründe, vol vi. p. 191.

(*c*) Zang; Operationen, vol. iii. pp. 34 and 40.

consequence; the whole after treatment consists in repeatedly drawing back the skin over the *glans* and bathing the *penis* in cold water. In a few days the patient is cured without any mutilation. I have frequently performed this operation, with the best result (*a*).

When the cellular tissue connecting the outer with the inner fold of the prepuce, is less extensible, and the outer fold itself less yielding, the latter must be so far cut into as to allow the prepuce being very easily drawn backwards and forwards (*b*).

Langenbeck (*c*) proceeds in a similar way, though manifestly less simple and satisfactory. After an assistant has forcibly drawn back the general coverings, he grasps the edge of the prepuce with a pair of forceps, introduced within it, and with a pair of scissors makes some little snips at different parts, and so many of them, till the whole prepuce can be completely drawn back. After each snip the prepuce must be still drawn back, till it be everted and the inner fold come into view, in which he then makes the snips which may be still necessary. In old and hard prepuce, with little extensibility of its inner fold, Begin (*d*) employs a practice which indeed is to be considered as a modified slitting of the prepuce already described. After previously slitting up the prepuce, he cuts off the corners of the flaps with scissors, so that the wound becomes round; he then retracts the skin of the *penis*, and cuts off the inner fold of the prepuce as far back as its base, with the scissors. The skin will soon draw together, and healing follows, a V-shaped scar being formed on the inner fold, by which its breadth is increased. According to Vidal de Cassis (*e*), the operator, whilst an assistant fixes the prepuce with a strong pair of forceps, from above downwards, passes through the prepuce, below the forceps, three transverse threads, and a fourth vertically from before backwards; then with strong scissors he cuts off the prepuce in front of the forceps, avoiding the threads. The forceps being then removed, the *glans* is partially exposed with the threads over it. The middle of each thread is now taken hold of with forceps, and being drawn a little forwards, four loops are made, each of which being cut through, eight sutures are formed, which after just sufficiently cutting through the inner fold of the prepuce strongly retracted are tied, and thus the edges of the outer and inner fold of the prepuce brought into contact.

1659. If the prepuce be united to the *glans*, after that it has been cut into where not united, the connexion must be separated with the spatula, the scissors, or the knife; but if their junction be so complete that no instrument can be introduced between the *glans* and the prepuce, a cut is to be made carefully lengthways through the prepuce without injuring the *glans*, and then it must be attempted by lengthening the cut upon the director or by careful dissection, in which the knife is to be always more towards the prepuce than the *glans*, to separate the connexion and remove the divided flaps. In all cases where the union is close and firm, where no instrument can be introduced between the *glans* and prepuce, the operation is excessively painful and difficult, and the result rarely corresponds to the expectation (*f*). In such case therefore the practitioner should be content, if the patient do not urge the more extended operation, to cut into the aperture of the prepuce so far, and so to enlarge it by the introduction of bougies that a free escape of the urine may be effected.

1660. When the connexion of the *glans* with the prepuce by bands is such that many functions of the *penis* are interfered with, the operator holding the *glans* with the thumb and forefinger of the left hand, whilst an assistant draws down and stretches the prepuce near the bands, introduces a narrow curved knife through the bottom of the triangular fold of skin forming the *frænum*, and draws it out. Lint moistened with lead

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(*a*) Foot, A critical Enquiry into the ancient and modern method of curing Diseases in the Urethra and Bladder, &c. London, 1826. 8vo. Eighth Edition.—Ferrier, Note sur l'Opération du Phimosis naturel; in Révue Médic., vol. viii. p. 305. 1822.—Chelius, Ueber Phimosis und Paraphimosis; in Heidelb. klin. Annal., vol. iv. pt. iv.

(*b*) Fricke, above cited.

(*c*) Neue Bibliothek für die Chirurgie und Ophthalmologie, vol. iv.

(*d*) Nouveaux Elémens de Chirurgie, vol. ii. p. 550. Second Edition.

(*e*) Traité de Pathologie externe et de Médecine Opératoire. Paris, 1838–41. Large 8vo.

(*f*) Richerand, Nosographie Chirurgicale, vol iv.

wash is put between the edges of the wound, and the prepuce kept retracted as much as possible till the cure.

1661. In the treatment of *phimosis* arising from inflammation, its three stages may be observed; *first*, swelling and inflammation of the *glans* which can be got rid of by the proper application of antiphlogistic remedies; *second*, such considerable swelling that the *urethra* is compressed, partial stricture thereby produced, and if unrelieved, abscess, ulcerations of the *urethra*, extravasation of urine, and gangrene of the coverings ensue; *third*, when the chronic *phimosis* cannot be altered or got rid of, the *glans* and the prepuce become firmly connected. In such case the prepuce has often entirely lost its cellular structure, and is thickened; the surface of the *glans* is covered with warts, shrivelled, the proper opening of the *urethra* scarcely to be found, and the *glans* often nearly entirely separated from the spongy body by a deep pit (*a*).

1662. The treatment of *phimosis* caused by simple excoriation or putrefaction of the cheeselike matter, requires frequent injections of warm water with a little *liq. plumbi acet.*, frequently bathing the *penis* in lukewarm milk and water, and placing it against the belly, and also leeches at a distance from the inflamed parts. When the inflammation subsides, slightly astringent injections may be used. If any hard swelling remain about the aperture of the prepuce, it is best to rub in mercurial ointment with camphor, and in œdematous swelling, bags of aromatic herbs, strewed with camphor.

1663. Syphilitic *phimosis*, depending on chancre or clap, first requires corresponding antiphlogistic treatment, blood-letting, leeching, softening poultices, and luke-warm injections, in order to wash out the matter collected between the prepuce and *glans*. As soon as the inflammation and swelling subside, mercury is to be used externally and internally; but if used earlier, there might be transition to gangrene. If with venereal clap and chancre *phimosis* be feared, it can often be prevented by frequent purifying injections, quietude, and laying the *penis* straight upon the belly. If after the inflammation, swelling, and narrowing of the prepuce have ceased, its growing together must be prevented by frequently drawing backwards and forwards.

Under the supposition that contact of the ulcerated surfaces is favourable to keeping up this kind of *phimosis*, and that it always subsides with the cure of the ulcers, many practitioners, putting off the use of mercury and blood-letting, merely introduce beneath the prepuce little rolls of lint smeared with cerate, and after a few days dry lint. This is repeated every twenty-four hours if the secretions of pus be considerable, but only every forty-eight hours if it be trifling. About the fourth day usually, the *glans* can be uncovered, when it may be slightly cauterized with nitrate of silver, and the application of dry lint assists in effecting a cure in from eight to ten days. (PIGNÉ).

1664. Inflammatory and venereal *phimosis* but rarely require operation, and mostly cause bad symptoms, violent pain, considerable bleeding, increased inflammation and gangrene; the danger of general infection is increased, and sometimes growths difficult to get rid of arise about the cut. The operation is only called for when the pus is so retained beneath the prepuce, that it cannot be washed out by injection and bathing, and can only get an outlet by ulceration. In such case, however, it is not necessary to divide the whole prepuce, but it is generally sufficient only to enlarge the aperture of the prepuce so much that the pus can escape and injections be admitted. If the retained matter form a large swelling at

(*a*) TRAVERS, above cited.

one or other part of the prepuce which runs on to bursting through, it must be opened with a lancet for the escape of the pus, and injected. If the prepuce be eaten through, and the *glans* protrude through this hole, it is best to cut off the prepuce on the side next the constricted part, as its opening cannot be again brought to its natural place.

1665. In those cases in which from the pressure of the inflamed and swollen prepuce upon the orifice of the *urethra*, the voidance of the urine is stopped, the ulceration must be prevented by the early introduction of an elastic catheter into the bladder, and if it already exist, at least the bursting of the *urethra*, and extravasation of urine which often causes gangrene of the whole *penis*, be prevented.

1666. The above-mentioned statement (*par* 1658) that congenital *phimosis* does not depend on narrowing of both folds of the prepuce, but merely on deficient extensibility of the inner one, is important in explaining the origin of *Paraphimosis.* If, for instance, the very narrow prepuce be retracted in connexion or in any other manner, its narrow aperture where the two folds meet, is situated like a cord behind the *glans*, the inner coat is turned outwards, and the prepuce everted. The inner coat forms one or more swellings, behind which, and mostly covered by it, the constricted part is exposed. The symptoms caused by *paraphimosis* are various according as the prepuce and *glans* had been previously healthy, or both inflamed, ulcerated, or in any other way diseased. In the first instance they are usually not of importance; the swollen, everted fold of the prepuce inflames and becomes more swollen, and especially on the sides and beneath, the swellings are greatest, become like bladders and transparent. The swelling spreads to the *glans*, but usually in a moderate degree. I have only once noticed priapism accompanying *paraphimosis.* In the second case, the inflammation and swelling are more quick and violent, as both the inner coat and the *glans* may be considerably swelled: retention of urine may occur from the contraction, and even gangrene of the *glans.* In both cases the prepuce may mortify, but usually only the constricted ring behind the *glans* is destroyed by ulceration in consequence of neglect. When the constriction is not very great, and the prepuce is not brought over the *glans*, its folds behind the *glans* may grow together by the accompanying inflammation, and in this way an irremediable deformity be produced.

1667. The *treatment* of *paraphimosis* always requires the replacement of the everted prepuce as quickly as possibly, which must be attempted in various ways. The *glans* should be squeezed with three fingers of one hand for several minutes, or plunged for some time in ice-cold water, to reduce its size, and then with the finger and thumb of the other hand, it must be attempted to draw the prepuce forwards whilst the *glans* is pressed back. This handling however is rarely successful if there be much swelling and some time have elapsed (1). If the *paraphimosis* be accompanied with inflammation, blood-letting, leeching, and other antiphlogistic remedies proportionate to it, must be employed: the handling just proposed will only increase the inflammation. Scarifications of the swollen prepuce, recommended by many, can only be useful by the bleeding. According to WALTHER (*a*) the swelling of the inner fold should be moderately pressed, so that it may slip in, and the prepuce return

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(*a*) Ueber die Reduction der Paraphimosis und über die Behandlung der Phimosis; in his Journal für Chirurgie und Augenheilkunde, vol. vii. p. 347.

to its place. By this easy and almost painless handling, WALTHER almost always effects his purpose; compression of the *glans* in doing this is unnecessary, but if this treatment be ineffectual, the operation is required.

[(1) The reduction of *paraphimosis* in this, which is the best way, is often exceedingly difficult, and always excessively painful, so that frequently a strong-minded person will scream like a child from the pain. I have, however, scarcely ever known it fail, and hardly remember it needful to perform any operation with the knife. It requires, however, great patience and perseverance, often for the space of half an hour, at the very least, and I have often succeeded when the prepuce had been everted six or eight days, and it might have been supposed that the adhesive inflammation would have prevented the replacement of the skin. Although the diminution of the bulk of the *glans*, by pressing the blood as completely as possible out of it, is a very important part of the proceeding, yet squeezing out the fluid effused in the prepuce is no less so; and unless both be done, there is great hindrance to the replacement of the skin. I, therefore, always first squeeze gently, but steadily, for a few minutes, the prepuce, till it become somewhat flaccid, and then firmly press the whole *glans* with the thumbs of both hands, whilst the two forefingers of each hand grasp the *penis* behind the everted prepuce, like a collar, and draw it forwards, whilst the thumbs empty and thrust back the *glans*. Or if I do not so succeed, I grasp the whole *penis* with the left hand, making the thumb and forefinger a collar behind the everted prepuce, which thus rests against it, whilst, with the thumb and fingers of the other hand, the *glans* is emptied, and thrust within the constricted ring, by pushing first one part and then another of the *corona glandis* till it get beneath the constricting band; and this done, the rest soon follows. Immediately that the least bit of the *corona* has been thus got in, that next it must be poked in (no better expression than this can be used) with the finger end, and so on the next, till the greater part has been thus returned, and the reduction is speedily completed. It must, however, be remembered, that directly the return has commenced, the poking must be continued without intermission, as, otherwise, the whole proceeding will have to be repeated, as, on the least cessation, the *glans* again fills and protrudes. If the everted prepuce do not relax by pressure, the constriction being so great that the effused serum cannot be dispersed easily upon the body of the *penis*, it will be found very convenient to make a few punctures through the skin, by which the squeezing presses out the fluid, and then the prepuce is rendered flaccid. It is always advisable to try this mode of proceeding even if part of the prepuce should have become gangrenous, as this is often merely superficial and the replacement puts a stop to its progress. After the reduction, it is well for some hours to wrap the *penis* up in linen, and keep it constantly wet with cold water, for the purpose of preventing the disposition to erection, and re-protrusion of the *glans*, but after that time, a warm poultice will be most agreeable to the patient's feelings, and most favourable to the dispersion of the inflammation. The soreness, however, will commonly continue for many days, proportionate to the severity of the constriction, and its duration. No attempt at retraction of the prepuce, to see what is going on inside, should be made for several days, or the mischief will probably recur.—J. F. S.]

1668. The operation for *paraphimosis* is best conducted in the following manner. A little fold of the outer skin of the *penis*, just behind the constriction, is to be raised and cut through; into this opening a small director, curved at its tip, is to be introduced, and thrust into the cellular tissue beneath the constriction, forwards, till it can be felt on the other side, and then upon it the constricting skin is to be cut through. After this operation the prepuce cannot generally be drawn over the *glans*, because it is too much swollen, and attempts to bring it forward are useless and dangerous; but it returns gradually when the inflammation and hard swelling of the prepuce diminish. If the return of the prepuce be impossible, on account of œdematous swelling, a few little cuts may be made, and its contents squeezed out. The longitudinal cut soon becomes transverse.

In the mode above mentioned, the operation for *paraphimosis* differs, in no respect, from that already described (*par.* 1658) for *phimosis*, namely, the division of the aperture and inner skin of the prepuce. The object of the operation is not the division of the swelling and of the *circular protuberance*, but of the retracted aperture, and of the inner fold of the prepuce. On this presumption, I cannot agree to the unsatisfactory opinion which Walther has given of the operation for *paraphimosis* (*a*). Langenbeck is also of the same opinion.

1669. If suppuration have already occurred at the circular constriction, the operation is superfluous, for the two folds of the prepuce are already divided, and there is merely the œdematous swelling, which drawing forward the prepuce prevents. In this case, the prepuce must either be brought forward in the way already described, by squeezing and diminishing the size of the swollen inner fold of the prepuce, or several little cuts must be made into it, so as to squeeze out the fluid.

1670. After the operation, merely cold water is to be applied, and the *penis* laid straight upon the belly. If, during the operation, the spongy body be wounded, and there be consequent bleeding, this must be stanched with cold water, or with pressure when it can be employed. An œdematous swelling of the prepuce frequently remains a long while after the operation, to disperse which bags of aromatic herbs, rubbing in mercurial ointment and camphor, and if these be inefficient, cutting into it, or moderate pressure by rolling the *penis*, should be employed.

1671. Constriction of the *penis* may also be caused by threads or thin tapes, and the like, which have been voluntarily put round it. The symptoms, in general, become quickly very severe; the place of constriction is speedily and completely covered by the swelling, and the band will quickly cut into the *urethra*. A thin director must be attempted to be passed beneath the band, which is then to be cut through with a narrow curved bistoury. If the constriction be caused by a metal ring, it must be cut through with a file, or with nippers, and removed in the most careful manner.

X.—OF THE NARROWING AND CLOSURE OF THE URETHRA.

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1672. *Stricture of the Urethra* (*Strictura Urethræ*, Lat.; *Verengerung der Harnröhre*, Germ.; *Rétrécissement de l'Urètre*, Fr.) results more frequently from a change of the mucous membrane with which it is lined, than in any other outlet. In women only it is very rare, on account of the shortness of the passage.

The narrowings of the *urethra* from other causes, will be treated of subsequently, in considering retention of the urine.

1673. The development of this disease is always exceedingly tedious, and at first is usually not noticed by the patient. He first feels a slight pain in passing his urine, and there is frequently some mucous discharge from the *urethra*, which spots the linen. Gradually more frequent urgency to empty the bladder comes on, and the voidance of the urine is accompanied with much straining. The stream of the flowing water begins to diminish in thickness, is frequently divided and spiral, or if the urine have been already discharged in a stream, a small quantity still falls vertically in drops. Frequently all the urine is not voided at once, and a large quantity is still passed on additional effort. When the proper discharge of the urine is completed, there still remains a small portion behind the strictured part, which, as the *penis* hangs down, gradually escapes by its own gravity. If there be several strictures existing at the same time, the stream of urine is powerless, and the urine drips away. In this state the patient long continues getting alternately better and worse; and after violent exertions, after taking heating food and drink, after connexion, and after catching cold, a momentary stoppage of urine may occur.

[Brodie justly remarks, that "in some cases the urine dribbles away constantly and involuntarily, and the patient's clothes by day, and his bed by night, are absolutely sopped with urine, making him disgusting to himself and to all around him. This involuntary discharge of urine does not indicate an empty and contracted bladder. The bladder, in fact, is loaded with urine, and it is when it does not admit of further distension that the urine overflows, and all beyond a certain quantity escapes, without the patient being able to prevent it, the bladder being at the same time to be felt like an enormous tumour in the lower part of the abdomen." (p. 11.)]

1674. At last the disease reaches its highest pitch; the urine can only be voided with the greatest effort and in extremely small quantity, and its discharge is often completely stopped. By the pressure of the urine against the stricture, the *urethra* behind it is expanded, and it may be so much that the *urethra* tears or is destroyed by sloughing, upon which the urine infiltrates into the neighbouring parts. If only a small quantity of urine be extravasated into the cellular tissue, it forms a hard, definite swelling, which runs on to abscess. In greater extravasation there is a spreading tumour, which may extend from the *perinæum* over the *scrotum*, *penis*, groins, and so on. The skin has at these parts a dusty red, shining appearance; gangrene soon comes on, and, after its separation, fistulous apertures are formed, by which the urine escapes. In this state the constitutional powers often soon sink, and the patient dies.

["Conceive," says Brodie, "a distended bladder, and the spasmodic action of the abdominal muscles and diaphragm of a powerful man acting like a syringe, and forcing the urine through the lacerated *urethra* into the cellular membrane. In fact, the *scrotum*, the *penis*, the *perinæum*, sometimes even the groins are enormously distended with urine. The first effect of this mischief is to relieve the patient's sufferings. There is no more straining, and the spasm of the stricture, no longer excited by the pressure behind, becomes relaxed, so as to allow some of the urine to flow by the natural channel. After this deceptive interval of ease, another order of symptoms shows itself. The urine, under any circumstances, would irritate the parts unaccustomed to its contact; but, in a case of retention of the urine, it has been long in the bladder, much of its watery parts have been absorbed, and it is in consequence unusually impregnated with saline matter, so that its stimulating properties are much increased. Wherever this acrid fluid penetrates, it first excites inflammation, and then kills the parts with which it is in contact." (p. 13.)

"In cases of stricture, where the disease has existed for many years, and nothing effectual has been done for its relief," Brodie observes, "abscesses form in the cellular membrane external to the bladder, but communicating with it, similar to those connected with the *urethra*. A considerable time elapses before such abscesses present themselves externally, and they point at last in the groin, or above the *pubes*, discharging a putrid, offensive pus in the first instance, and giving exit to urine afterwards. In Dr. Hunter's Museum (now at Glasgow) there is a preparation exhibiting an abscess of this kind communicating with the bladder at the *fundus*, extending upwards in the course of the *urachus*, and opening externally at the navel. I believe that the formation of these abscesses is always preceded by chronic inflammation of the mucous membrane of the bladder, and their existence is marked by severe typhoid symptoms. For the most part they may be regarded as a sign of approaching dissolution." (p. 26.)]

1675. If this do not happen, however, severe symptoms arise from the changes which the mucous membrane of the hinder part of the *urethra* undergoes in severe and long-continued strictures. By the constant irritation of the urine collected behind the stricture, it swells up and becomes spongy; this change spreads upon the mucous membrane of the prostatic part of the *urethra*, the prostate itself enlarges and its mucous follicles swell considerably (1). Hence arises the sensation of weight in the *rectum*, the frequent, often useless straining at stool, the mucous, sometimes purulent discharge which precedes the flow of urine; the fibrous, tenacious urine, with the deposit of long mucous threads upon the bottom of the chamber-pot, which may be drawn out to the extent of two or three feet. The hind part of the *urethra*, and the neck of the bladder at last become so expanded, that the urine is only retained by the stricture, and drips involuntarily (2). By the extension of this diseased change in the mucous membrane to the excretory canals of the *semen*, and the seminal vesicles, there is frequent swelling of the testicles, very quick discharge of the *semen* in connexion, (in which it also escapes without elasticity, and often before the venereal orgasm is finished,) and frequent nightly pollutions. In very severe state of the disease voidance of the *semen* at a half erection, without the patient having any sensation of it, with the efforts to discharge the last drops of urine, and in going to stool, occurs. These changes at last reach the mucous membrane of the bladder, the walls of which then often become considerably thickened; they extend even along the ureters to the *pelves* of the kidneys, which, in like manner, are expanded (3). The great disturbance of the general health which accompanies long-continued stricture now appears; the more or less disturbed digestion, wasting, feverish symptoms at uncertain periods, often accompanied with violent headache and great heat, sometimes with shivering and without particular heat, at other times with cold shivers, great heat, and copious sweating (4).

[(1) The following observations of Brodie, in reference to the combination of stricture, with enlargement of the prostate, are most truthful and well put, and, if borne in mind, will save the patient pain, and the Surgeon credit. "Although the combination of stricture with enlarged prostate is common enough; yet it is not," says he, "so common as it is by some Surgeons supposed to be. An old man, who has a frequent desire to void his urine, and voids it slowly and with difficulty, applies to a Surgeon, whose hand is light and accustomed to the use of the catheter. The instrument is then introduced readily, or, at any rate, meets with no obstruction until it reaches the neck of the bladder, and the case is set down as one of enlarged prostate, which it really is. Another old man, under precisely similar circumstances, applies to a Surgeon, who uses the catheter rudely and incautiously. The *urethra* resents this rough usage; spasm is induced, and the point of the catheter cannot be passed further than the membranous part of the *urethra*. The case is then supposed to be one of stricture, and is treated as such; I need not tell you to how little purpose." (p. 23.)

(2) Brodie mentions a remarkable instance of enlargement of the *urethra* following "stricture at the distance of three inches behind the external *meatus*. The posterior part of the *urethra* was so much dilated, that, whenever he made water, a tumour, as large as a small orange, and offering a distinct fluctuation, presented itself in the *perinæum*: it might be compared to a second bladder. Once, when he sent to me labouring under a complete retention of urine, I punctured the tumour in the *perinæum* with a lancet. Immediately the urine gushed out in a full stream." (p. 8.)

(3) "In some instances," Brodie observes, "the mucous membrane is protruded through some of the interstices of the muscular fibres, forming numerous small cysts, communicating with the cavity of the bladder. These cysts appear to be formed in the following manner; when the patient strains in making water, the mucous membrane, while it is pressed on by the muscular fibres externally, has to sustain an equivalent degree of pressure on its inner surface from the reaction of the urine. Wherever there happens to exist a small interstice between the muscular fibres, the latter force alone operates, and the bulging outwards of the mucous membrane is the necessary consequence. These cysts, however, are not peculiar to cases of stricture of the *urethra*, and they occur equally where the obstruction to the flow of urine arises from an enlargement of the prostate gland, or from any other cause." (p. 25.) He mentions "a case of long-neglected stricture of the *urethra*, in which, on examining the body after death, I found one of the cysts interposed between the bladder and *rectum*; at least, equal in capacity to the bladder itself. * * * For the most part the contents of the cysts are similar to those of the bladder itself; but I shall have occasion to mention a case in which a large cyst of this description contained pure pus, while in the bladder there was nothing but urine." (pp. 25, 6.) He also observes that he has "met with several cases of stricture of the *urethra*, in which the mucous membrane of the bladder was found, after death, not only inflamed, but encrusted, even over a large portion of its surface, with coagulated lymph. Such an effusion of lymph is the result of acute inflammation, differing in its character from the chronic inflammation which produces merely a secretion of the vesical mucus; and it is observed chiefly (if not exclusively) when the patient has died after having been harassed by repeated attacks of retention of urine." (p. 24.)

(4) "Rigors also occur," says Brodie, "in many cases of stricture, independent of abscess. We meet with them most frequently in patients from hot climates. They usually recur at irregular periods, being in many instances brought on by the introduction of a bougie, or the application of caustic to a stricture. The paroxysm very nearly resembles that of an intermittent fever, and it is more severe when it follows the use of a bougie than when it occurs independently of it. In general, the cold fit having been followed by a hot fit, and that by a profuse perspiration, the patient is relieved. At other times, however, the constitution is disturbed for a great length of time afterwards; and sometimes the rigor is followed by an attack of continued fever, which lasts for some

days, or even for some weeks. I met with a case in which a rigor followed the application of caustic to a stricture, and this was followed by an attack of mania, which (if my recollection be correct) did not subside for nearly a month. Another patient had laboured under a stricture of the *urethra* for many years, during which no instrument had ever been made to enter the bladder. I succeeded in introducing a small gum catheter. Having emptied the bladder, I removed the catheter. In a few hours after there was a severe rigor. An attack of fever ensued, attended with rheumatic inflammation of the muscles of the neck, from the effect of which the patient never entirely recovered, though he lived for many years afterwards." (pp. 27, 8.)]

1676. The origin of stricture always depends on, and is accompanied with, a chronic inflammatory state of the mucous membrane of the *urethra*, by which it is swollen up, thickened, and loses its natural extensibility. In many instances the immediate cause of stricture is unknown. It is frequently observed after *gonorrhœa*, especially if that have been long continued, and improperly treated. The causal relations, however, which the stricture has to a previous clap, are often unknown, as it is observed after both severe and slight clap, whether treated with or without injections. Strictures, also, commonly appear long after *gonorrhœa*, often as long as thirty or forty years. Neither their seat nor their extent at all corresponds with that of the previous gonorrhœal inflammation. Scrofulous or gouty inflammation, long-continued onanism, accidents which befal the *urethra*, and long suffering with stone in the bladder, especially in old persons, may be causes of stricture. Warm climates seem to be more favourable to their development than cold. Varicose swellings of the vessels, as well as tumours in the neighbourhood of the *urethra*, may also produce them.

[Brodie mentions that " in some cases of long standing, we find a gristly indurated mass at the lower portion of the *penis*, where it is covered by the *scrotum*. This is, probably, in some instances, the contracted portion of the *urethra*, thickened and converted into a substance approaching in its character to cartilage. But, in other cases, it depends on a different cause. A gentleman laboured under a stricture, and voided his urine with great difficulty. A hard oblong tumour could be felt in the neighbourhood of the stricture, though somewhat anterior to it, at the upper part of the *scrotum*. I dilated the stricture so as to enable the patient to introduce a bougie for himself; but still the stricture remained unaltered. He died about a year afterwards of an accidental attack of disease in the brain; and I found, on dissection, that the tumour had arisen from a deposition of lymph into the cells of the *corpus spongiosum*. Immediately behind the stricture there was an orifice leading into a long and narrow sinus, extending from the *urethra* into the gristly substance of the tumour. The direction of the sinus was from behind forwards, so that it was evident that it could not have been produced by the improper use of the bougie. I conclude that it was the result of the forcible and the repeated pressure of the urine against the *urethra* behind the stricture." (pp. 8, 9.)]

1677. The most common seat of stricture is at four and a half, or five and a half inches from the orifice of the *urethra*, rarely at other parts (1). The strictured part is, according to the duration of the complaint, more or less hard, white, almost fibrous, generally of slight extent, not exceeding a line's breadth, as if the *urethra* were tied round with a thread ; but sometimes it is wider, and then not equally thick, and the canal of the *urethra* is variously curved. These changes seem to result from repeated severe attacks of inflammation, which even affect the spongy body of the *urethra*, and render it thick and hard. Sometimes several distinct strictures exist at the same time. Stricture does not always attack the whole circumference of the *urethra*, it is often valvular, or tape-like, divided and branching, and sometimes runs lengthways. Not unfrequently strictures are noticed, the middle of which is ulcerated. Complete closure of the *urethra* from stricture is very rare; but most commonly in long-continued stricture, the *urethra* in front of it is contracted. The so-called *caruncle*, or growth from the inner membrane of the *urethra*, which was formerly considered the most common cause of stricture, and probably nearly always confused with what we call stricture, is rare. They are frequently found as little masses of soft warts behind the stricture; at other times they are not found behind, but before the stricture; they are commonly similar to those growths observed on the prepuce and *glans*. I have seen in one person, who had frequent claps, the *urethra* filled with round excrescences for an inch behind the *fossa navicularis*.

Hunter (*a*) has described three forms of stricture of the *urethra; first*, a permanent stricture depending on a change in the structure of the *urethra; second*, a mixed condition of permanent and spasmodic stricture; and, *third*, a simple spasmodic stricture. The adoption of this third kind rests on the notion that the inner membrane of the *urethra* is endowed with actual capability of expansion and contraction, depending on its muscular nature. This opinion is contradicted by examination, which shows that the membranous part of the *urethra* is surrounded with an injectable tissue similar to the spongy body, but in which no muscularity can be discovered (*b*). Charles Bell (*c*), who considered the *urethra* to be simply elastic, supposed that many symptoms of stricture depended on the influence of the perinæal muscles surrounding the neck of the bladder and the *urethra*. Although there may be some grounds for this opinion, a certain capability of contraction and expansion cannot, however, be denied to the *urethra*, as so many excretory passages which equally exhibit no muscular character, and where only very rich vascular ramifications are noticed, are so endowed, without, on that account, distinguishing with the name, *spasmodic stricture* something else than a stricture (depending on a change of structure in the inner membrane of the *urethra*) which is accompanied with great inflammation, great sensibility of surface, or in the neighbourhood of the canal of the *urethra*, and with increased irritability of the surrounding muscles, by which a great degree of stricture may be produced. Here, also, must be distinguished from spasmodic contraction of the *urethra* and neck of the bladder those cases which come on without inflammation and organic change, and merely as a symptom of diseasedly increased sensibility of the bladder and the *urethra*, and mostly only transient (*d*). It must also be remembered, that even spasm may accompany every acute and chronic inflammation. The mistake must not be made of assuming the existence of spasmodic stricture, because on examination of the *urethra* after death no trace of stricture can be found, of which, during life, there were symptoms, and which generally depends on the mode of examination, as, if it be not carefully conducted, nearly everything disappears on cutting into the stricture (*e*).

[(1) "In the majority of instances," observes Brodie, "the disease (stricture) began in the anterior portion of the membranous part of the *urethra* immediately behind the bulb and in the situation of the triangular ligament of the *perinæum*; that in some instances it had its origin in the *urethra*, somewhere between the part just mentioned and the external orifice; and that in a few cases it is confined to the external orifice, and the canal immediately adjoining to it. Occasionally where the original and principal stricture has been in the membranous portion of the *urethra*, there is another stricture anterior to it; and in cases of very long standing it is not unusual to find the greater part of the canal in a thickened and contracted state. (p. 4.) A stricture which affects the external orifice, and anterior extremity of the *urethra*, is, in many cases, connected with an adhesion of the inner surface of the præpuce to the *glans*. Such adhesion is usually the consequence of a congenital narrowness of the præpuce, combined with want of due attention on the part of the nurse to the child's cleanliness; and hence it is that patients who labour under this kind of stricture, frequently declare that they do not know when the disease began, and that they cannot remember the time when the urine flowed in a full stream." (pp. 6, 7.)]

1678. The diseases which may be confused with stricture are, inflammation of the *urethra*, clap, spasm of the muscles surrounding the *urethra*, abscesses or swellings in its neighbourhood, stone, and diseased prostate.

(*a*) Above cited, p. 120.

(*b*) Shaw, John, On the Structure of the Membranous Parts of the Urethra; in Med.-Chir. Trans., vol. x. p. 339. 1819.

(*c*) Above cited.

(*d*) Soemmering, above cited, p. 216.—Lisfranc, above cited.

(*e*) Amussat, above cited.

A close inquiry into the course of the disease, a careful examination, and the following circumstances decide the point. In stricture, the discharge after connexion occurs quickly, and recurs usually after a week; a clap rarely appears before the third day, increases, and the pain on making water and inflammation become more severe. Stoppage of the *urethra* by stones is distinguished by the previous symptoms of stone, by the sudden stop to the flow of urine, and the striking of the sound against the stone. Swelling of the prostate is felt by the finger through the *rectum*, the catheter can be readily introduced as far as the prostate, but it then frequently excites severe pain, and most commonly only an elastic catheter can be introduced.

1679. The *prognosis* in stricture of the *urethra* varies according to the seat and condition of the disease. The nearer to the orifice of the *urethra*, the more recent and extensible, the shorter and narrower the stricture is, so much the more easily can it be got rid of. When, however, the symptoms mentioned (*par.* 1675) have set in, the *prognosis* is more doubtful, except that the patient's condition may be rendered tolerable; it cannot, however, be decided whether after the removal of the stricture, these symptoms will diminish or cease. The treatment is in many cases tedious, and relapses are very frequent. If urinary fistula have already formed, what has been already mentioned (*par.* 948) must be borne in mind.

1680. In the cure of stricture, two circumstances must be distinguished, namely, whether the voidance of the urine be completely stopped, or whether the patient suffer under the common symptoms of stricture; the latter only will here be considered, but the former in treating of retention of urine.

1681. The object in the *treatment* of stricture, is to get rid of the obstacle which opposes the passage of the urine, and which is to be effected either by gradual *widening* of the canal of the *urethra*, by the introduction of foreign bodies, as tapers, bougies, or catheters; or *destruction of the stricture* with caustic, with conical catheters or special instruments. If the stricture be in causal relation with *syphilis* or any other dyscrasy, they must be counteracted. General treatment, however, has not in itself any effect on stricture.

1682. The first object of the treatment by *widening* or with *bougies*, is to determine the seat of the stricture. For this purpose, an elastic wax bougie corresponding in thickness with the orifice of the *urethra*, and smeared with oil is to be introduced into the aperture of the *urethra*, the *penis* being held with the finger and thumb of the left hand behind the *glans*, but without pressing the *urethra*. The *penis* is then drawn up, whilst the bougie, held like a writing pen, and gently rolled from side to side, is passed in so as not to get entangled in the mucous membrane. When the bougie has reached the seat of stricture, a mark is to be made on it with the nail close to the mouth of the *urethra*, and thus the distance of the stricture from it is shown.

[" The bougie which is used for the purpose of examining the *urethra* should," says Brodie, " be of a full size, that is, large enough to fill the *urethra* without stretching it. A small bougie may deceive in two ways: it may pass through a stricture, and thus lead you to believe that there is no stricture when there really is one, or it may have its point entangled in the orifice of one of the mucous follicles of the *urethra*; or in some accidental irregularity of the canal, and lead you into the opposite mistake of supposing that there is a stricture where none exists. If you use a bougie of the size of the *urethra*, you are not at all liable to the first error, and you are much less liable to the second than you would be otherwise." (pp. 29, 30.)]

1683. A thinner elastic or wax bougie, about the thickness of the stream in which the urine flows is now taken, and a mark made upon it at the same distance from its point as on the former one; after which, being introduced as already directed, an attempt must be made to pass it through the stricture, in doing which all violence must be avoided. The entrance of the bougie beyond the nail-mark shows it has passed the stricture, and this is still further proved when, on drawing it back, it is somewhat held, and if left quite alone it does not rise up. The last circumstance shows that the bougie has bent in the canal of the *urethra* in front of the stricture without penetrating it. If the point of the bougie enter a mucous follicle, it is known by the nearness of the obstacle to the orifice of the *urethra*, by the pain the patient feels, by its further progress when the bougie is drawn a little back, which is effected without the least difficulty, and then again introduced in a different direction, and by the absence of any impression of the stricture which is always observed, when the bougie is withdrawn, to have been made by the stricture. If the bougie will not enter, a smaller one should be tried. If the condition of the stricture be such as to render the passage of the bougie impossible, we must endeavour to obtain an impression of it with Ducamp's model-bougie, presently to be described, which must be pressed against it a little while for that purpose, so as to give to the point of the bougie to be introduced the proper curve by which perhaps it will pass through the stricture. Or a very thin bougie is to be carried down to the obstacle, and there left some hours, from eight to twelve; afterwards it will of itself enter the stricture and pass into the bladder (Dupuytren.) When the bougie have to be pushed beyond the curve of the *urethra*, beneath the arch of the *pubes*, it is most advantageous to give it a proportionate curve, or to introduce a stilette of lead or iron properly curved into the cavity of an elastic bougie. Or if a straight bougie be carried beyond the curve of the *urethra*, as soon as its point gets under the pubic arch, the *penis* must be depressed to lessen the curve of the canal, the bougie gently rotated as it is pushed forwards, and assisted by pressure of the finger in the *perinæum*.

The introduction of the bougie is often rendered difficult by the spasmodic contraction of the muscles surrounding the *urethra*, especially in irritable persons, or if the stricture be in an inflammatory state. In this case the introduction of the bougie may be often effected, if a slight rubbing be made on the *perinæum* with one hand, whilst the instrument is gently pressed forwards with the other, or if it be allowed to lie some time upon the stricture, and then attempts made to pass it farther. Under these circumstances, remedies which lessen the great irritability, as luke-warm bathing, clysters, leeches, and the like should sometimes precede the use of the bougie. No force should ever be employed in passing a bougie; if it will enter only a few lines deep into the stricture, there it should be allowed to remain, and by repeated introductions it will pass further.

Common bougies, *wax bougies*, are prepared in the following manner:—A piece of fine linen, which has been already used, nine inches long and to an inch in width, according to the thickness of the bougie to be made, is to be dipped into melted plaster, and when a little cooled, spread flat and even with a spatula; it is then to be rolled together between the fingers and afterwards between two plates of marble till it is quite firm and smooth. The bougie must be equally thick throughout its whole length to about one inch from its point, from whence it should gradually taper and terminate in a firm round point. Bougies are also made by dipping cotton threads in melted wax till they have acquired sufficient size, after which they are rolled between marble plates. By the addition of various medicaments to the substance of which bougies are formed, were made the *bougies médicamenteuses* formerly in use. The *elastic bougies* are to be preferred, as besides their flexibility they are also tolerably firm, and not so easily dissolved by the urine. If hollow, an iron stilette may be introduced into them, and their strength thereby be much increased.

Wax bougies seem preferable to elastic ones in all cases where there is difficulty in penetrating the stricture, as, on account of their great flexibility, the *urethra* is not easily injured. In very narrow strictures, the introduction of silk-worm gut bougies has been recommended, which enlarge about half their size, and by their softness yield to the directions of the canal. The objection made to them, that by their irregular and hard point, they injure the canal of the *urethra*, and even pierce through it, may be diminished by their proper preparation, and careful introduction (*a*).

If the wax bougie, when it has penetrated the stricture, be a little while withdrawn, an impression upon it from the stricture is observed, by which the condition and extent can be determined. The same also happens with the silk-worm gut bougie.

[In passing wax bougies, Astley Cooper (*b*) directed "always to warm them by the fire, for the purpose of rendering them soft; when, if they are introduced into the *urethra* and pass through the stricture, you will ascertain the distance at which it is situated from the orifice, and the form and size of the stricture will be modelled on the bougie. You then pass another bougie a little longer than the first, and directly that is withdrawn, another still larger. On the following day you again introduce two bougies, that is, if there should be no existing inflammation to prevent it; the first bougie you then use is to be of the same size as the one with which you concluded on the previous day; after this has been withdrawn, you again pass another, a size larger than the first, thus using on every occasion two bougies, always beginning with one of the same size as that with which you had concluded on each preceding time. By adopting this plan, strictures may be cured in a quarter of the time that they usually are, and the strictured part of the *urethra* speedily made to regain its natural size. * * * Never attempt to pass a bougie in its straight state, for if you do, it will be obstructed in its passage, whether there be stricture or not. You invariably give it, before its introduction, the curve of the catheter." (p. 223.)

Abernethy (*c*) says:—"You should pass a bougie very gently, and withdraw it immediately after the first application, and if no reaction ensue, you will find that the part will bear twice as much next time; but if you pass it roughly, the contrary will happen, and you will increase the disorder. You should never repeat the passing a bougie till the effect of the first stimulation is completely gone off. In many cases there is no necessity for introducing them more than once a week."

Brodie justly remarks:—"Success in the cure of this disease will depend on your attending to this important rule. Whether you use a bougie, or a sound, or a catheter, let the instrument be held lightly, and, as it were, loosely in your hand; it will then in some measure find its own way in that direction in which there is the least resistance; whereas, if you grasp it with force, the point can pass only where you direct it, and it is just as likely to take a wrong course as a right one. A stricture will invariably resent rough usage; it will yield to patience and gentle treatment." (p. 68.)

In the treatment of stricture of the *urethra*, there is difference of opinion as to the material of which the bougie or sound should be made, whether wax, elastic gum, catgut, or metal is to be preferred; and whether such instrument should be conical or cylindrical.

Astley Cooper says:—"The bougie I use is made of silver; it is of the form of the catheter, but at the point, and running back for some distance towards the handle, it is conical. The way I use it is this, I first pass down in the manner above described, a wax bougie, for the purpose of ascertaining the form, size, and distance of the stricture. Having obtained a knowledge of these, I then introduce my conical silver bougie, the point of which having entered the stricture, the further it passes the greater is the dilatation produced, in consequence of the form of the instrument. This bougie I have found extremely serviceable, and is the best with which I am acquainted. When it is not at hand I use a common silver catheter instead." (pp. 223, 24.)

Abernethy observes:—"Metallic instruments are good in some cases; if there be a spasmodic stricture at five inches, and another at six, and one beyond it, when a common bougie is passed it may get by the first stricture, but when it reaches the second it

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(*a*) Kothe, die Harnröhren-Strictur und ihre Heilung; in Rust's Magazin, vol. xv. p. 1.

(*b*) Lectures; in Lancet, 1833, 4, vol. ii. Third Edition.

(*c*) MS. Lectures on Surgery.

will be so griped by the one through which it first passed, that it will go no further: here, then, the metallic is useful; it cannot be indented, and, being exceedingly polished, it slides on, but it requires great knowledge of the direction of the canal, and great gentleness in passing it."

In the following observations it will be seen that **Brodie** considers difference of situation of the stricture requires corresponding modification in the treatment with instruments.

"Strictures in the anterior part of the *urethra*, but behind the orifice," says he, "require to be mechanically dilated by the introduction of bougies or metallic instruments. At all events, I know of no better method of treatment; and sometimes the patient obtains relief on very easy terms, the dilatation being readily accomplished, and the use of a bougie once in three or four days being sufficient to prevent a recurrence of the contraction. At other times, however, the disposition to contract is so great, that it becomes necessary to introduce the bougie once or twice daily; and, indeed, I have known cases in which the patient was seldom able to expel his urine until the bougie had been employed.

"The simple rules which have been just laid down are not sufficient for the treatment of strictures at the bulb of the *urethra*. The circumstance of these being situated where the curvature of the *urethra* begins, at a distance of six or seven inches from the external orifice, and their liability to spasm, distinguish them from strictures in the anterior part of the canal. The management of them requires greater skill, attention, and experience on the part of the Surgeon; but, at the same time, it must be acknowledged that it leads, on the whole, to more satisfactory results than that of strictures which take place elsewhere. If you were to ask me, how then do you treat strictures at the bulb of the *urethra*? my answer would be, I have no particular method: sometimes I adopt one method, sometimes another, according to the peculiar circumstances of the case. (p. 49.) The methods which are chiefly useful in the case of stricture at the bulb of the *urethra*, are: *First*, The dilatation of it, by means of the common plaster bougie. *Secondly*, The dilatation of it by means of the metallic bougie, catheter, or sound. *Thirdly*, the retention of the gum catheter in the *urethra*, and bladder. *Fourthly*, The application of the bougie armed with nitrate of silver.

"The common plaster bougie, if of small size, should be of a conical shape, but if of a middle size or of a full size, it should be cylindrical. Ascertain the size of the stream of urine, and introduce a bougie of this size, whatever it may be. If the bougie be very small, it may be used straight, otherwise it should be curved like a catheter, but in a less degree. Neither you nor your patient are to be disappointed because the bougie does not enter the stricture at the first trial. In many cases this will not happen until you have seen your patient three or four times; and in very difficult cases, the delay may be still greater than this. When a bougie has once entered the stricture and bladder, allow it to remain for a few minutes. In two or three days introduce either the same bougie or one of the same size. Then withdraw it, and use one of a size larger. Allow this to remain for a few minutes, and after two or three days more, repeat the operation. Thus, by degrees, you dilate the stricture, until it is of the same diameter with the rest of the *urethra*. This method of curing strictures is applicable to a great number of cases; and, whenever it will answer the purpose, I would advise you to resort to it in preference to other methods. The common bougie gives little or no pain; it excites no irritation, unless it be introduced clumsily or rudely; and it can do no harm by penetrating or tearing the membrane of the *urethra*.

"The metallic instruments which I am in the habit of employing are not those which are sold under the name of flexible metallic bougies. These are liable to lose the shape which you have given during their introduction, and, in fact, are at the same time too flexible and too inflexible for any useful purpose. Those which I have, if of a small or middle size, are made of solid silver, the larger ones of silver or steel, or steel plated, or of a composition similar to, but firmer than, that of the flexible metallic bougie. These sounds should be very slightly curved, and for ordinary cases not more than eight inches and a half or nine inches long, exclusive of the handle. You may use them as you would use the common bougie, for the purpose of gradually dilating the stricture, beginning with one of a small size, and gradually proceeding to those which are larger. Sometimes you will find it best to introduce the sound without turning, that is, with the concavity towards the patient's *abdomen*; at other times, you will pass it more readily by keeping the handle, in the first instance, towards the patient's left groin, turning the instrument afterwards as it approaches the stricture. In either case, if you wish to avoid making a false passage, take care that the point is kept *sliding*, as it were, against the upper part of the *urethra*. Press the instrument firmly, but gently, against the stricture, in the expectation that it will gradually become dilated and allow the point to enter; then depress the handle, and pass it into the bladder, provided that you can do so readily, and without the application of force, but not otherwise. Two or three days afterwards, (and the interval ought to be never less than this, and sometimes it ought to be greater,) introduce the sound which has been passed before, withdraw it, and introduce another of a size larger; and thus go on dilating the stricture until that part of the *urethra* has regained its natural diameter. If in the course of these proceedings you are in doubt whether the sound has reached the bladder or not, you may easily determine the point in question by introducing a catheter. You might, indeed, use the catheter from the beginning, but that the openings near the point, and its comparative lightness, render the introduction of it less easy than that of the solid instrument. This method of treatment is applicable to a large proportion of the cases which you will meet with in practice: *first*, to those of old and indurated strictures, which the common bougie is incapable of dilating; *secondly*, to those in which, in consequence of some improper management, a false passage has been formed, into which the point of a common bougie will easily penetrate, but which an inflexible instrument may be made to avoid; *thirdly*, to those in which, from long-continued disease, and without any previous mismanagement, the *urethra* has become distorted and its surface irregular; and, *fourthly*, to several recent cases, in which the smooth, polished surface gives less pain to the *urethra*, and is less likely to induce spasm, than the softer, but less smooth surface of a common bougie. (p. 51–4).

"In treating a stricture of the *urethra* with the gum catheter, you are to introduce it and allow it to remain day and night in the *urethra* and bladder. If the patient can bear it to be retained for a sufficient length of time, the stricture will become dilated not only to the size of the instrument employed, but to a size considerably larger. Perhaps you will be able to introduce the catheter without the wire or stilette. Do so, if possible. If not, you should employ one mounted on a strong, unyielding iron stilette, having a flattened handle, like that of a common sound or staff. Being so mounted, it is more readily directed into the bladder than when mounted in the usual way on a piece of thin flexible wire. When the gum catheter has entered the bladder, withdraw the stilette, and leave the catheter with a wooden peg in its orifice, which the patient is to take out whenever he has occasion to void his urine, it being at the same time secured by a suitable bandage. After three or four days, you may withdraw the catheter for twelve hours; or, if much suppuration be induced in the *urethra*, you may withdraw it for a longer period. Then introduce another catheter, larger than the first; and thus you may, in the course of ten days or a fortnight, dilate a very contracted *urethra* to its full diameter. This is a very certain and expeditious method of curing a stricture. You may by these means sometimes accomplish as much in the course of ten days as you would accomplish in three months by the occasional introduction of the bougie. This method is particularly applicable, *first*, where time is of much value, and it is of great consequence for the patient to obtain a cure as soon as possible; *secondly*, where a stricture is gristly and cartilaginous, and therefore not readily dilated by ordinary methods; *thirdly*, where, from the long continuance of the disease, the *urethra* has become irregular in shape, or where a false passage has been made by previous mismanagement. Under these circumstances, if you can succeed in introducing a gum catheter, and let it remain for a few days in the bladder, you will find your difficulties at an end; the irregularities will disappear, and the false passages will heal; *fourthly*, there is still another class of cases in which this method of treatment is particularly useful. I allude to those in which a severe rigor follows each introduction of the bougie. This disposition to rigor is such, that it is sometimes impossible to proceed with the treatment in the ordinary way. Observe, in these cases, when the rigor takes place. It seldom follows the use of the bougie immediately. It almost always occurs soon after the patient has voided his urine, and seems to arise not as the immediate effect of the operation, but in consequence of the urine flowing through the part which the bougie has dilated. Now, if instead of a bougie you use a gum catheter, and allow it to remain, the urine flowing through the catheter, the contact of it with the *urethra* is prevented, and the rigor is prevented also. I have no right to say that this plan will invariably succeed, but I do not remember that it failed in a single case among many in which I have resorted to it." (p. 57–9.)

Although the harmlessness of plaster bougies is asserted by the high authority just quoted, yet I cannot accord with that statement, for I am quite sure that they are very frequently exceedingly mischievous, and that, even with the greatest caution, much injury may be done by their frequently slipping from the stricture and perforating the wall of the *urethra* in front of it, and producing false passages, and not very uncommonly laying the foundation for urinary abscess and fistula. The quickness with which they often soften by the mere heat of the part is so uncertain, that it is almost impossible to be sure of the precise quantity of pressure which they will bear; and when they once begin to yield, they speedily curl and twist in a very extraordinary manner near their tip, and, though they may not actually penetrate the wall of the *urethra*, yet they may seriously damage it by their increased bulk at this part, as the curve assumes the shape of a corkscrew to a less or greater extent. I have known bougies pushed through the *urethra* again and again, and false passages formed whilst the Surgeon supposed he was making progress in the cure of the stricture, when, in reality he was making matters worse. There are, I apprehend, more false passages made with them than with any other instrument, and few Museums are without examples of such results. I therefore have long since almost entirely given up using bougies, and prefer a catheter or a sound, as with either of these the precise quantity of pressure made, as well as the actual course which the point of the instrument takes, is more readily ascertained, and if it be inclined to go wrong can be more easily and satisfactorily corrected. And with them there is little or no excuse for tearing the *urethra*, In addition to which, experience shows, that the smoother surface of the metallic instrument greatly favours its movement along the *urethra*, and that its tip will often, without difficulty, overcome any little spasm about the stricture, and pass through it, when it is impossible to make a bougie move on without mischief. I do not think it of much consequence whether a catheter or a sound be used; perhaps the former has the advantage of showing at once its entrance into the bladder, by the flow of urine through it, whilst the latter, on the whole, passes more readily, and with less resistance, as its own weight gently urges it on, if it be only kept in the proper direction. A silver sound is preferable to a steel one, as most practitioners who have been in the habit of using it will bear testimony; but it should be solid silver, and not, as is too commonly the case, merely a silver catheter filled with composition, which is not only less weighty than the solid one, but is liable to be broken in two if it be necessary to make any alteration in its curve, as is not unfrequently requisite, to adapt it to the particular case. I think, also, the conical form recommended by ASTLEY COOPER is highly advantageous, and of the best which can be used. A couple of them is amply sufficient for any Surgeon's armamentarium, of which the point of one should be that of No. 3 or 4, and of the other that of No. 5, increasing in size upwards to Nos. 10 and 12 respectively. Some practitioners are in the habit of using a straight sound like a skewer, with a conical point; but if the stricture be in the membranous part of the *urethra*, it is a very dangerous instrument in the hands of most persons, and not adapted, I think, for general use.

The excellent directions given by BRODIE for the introduction of the sound or catheter leave little to be added. The importance of avoiding all violence cannot be too strongly urged. An instrument to be passed into the bladder should rather, as ABERNETHY used to say, be "coaxed," not forced. There are, however, other two points which must be carefully attended to in this operation; the *urethra* may fall into folds, either in its length, or in its transverse diameter, in consequence of which the point of the instrument becomes entangled, and will be at once stopped, and may or may not be thrust through the side of the canal, although at the part where the hitch is, no stricture exists. The *urethra* folds lengthways, when the instrument does not completely fill it, for which reason it is always advantageous to introduce such an one as nearly of the size of the urethra, as will have a chance of its point entering the stricture; and I am convinced that there are few strictures in which it will be necessary to commence operations with one smaller than No. 6 or No. 4; provided the cure only of the stricture is considered, and not the immediate relief of the bladder from retention of urine, in which case a small instrument is admissible. But small catheters or sounds are at all times very dangerous, except in more dexterous hands than those by which they are commonly used; and, as they more quickly slip through the wall of the *urethra* than larger ones, the patient's condition is rendered worse than before, because it often becomes necessary to suspend the use of instruments, if luckily the accident should be discovered, which is far from commonly the case, till the tear has healed up, even if it do not give opportunity for the escape of the urine, and so give rise to abscess. The transverse folding of the *urethra* most commonly occurs in the membranous part, and may happen whether the instrument be small or large, and the obstruction thus produced very frequently leads to the presumption of a stricture when none really exists. This transverse folding depends on the *penis* and *urethra* not being sufficiently drawn forward upon the instrument; so that, when the handle of the instrument is depressed to tilt the point up behind the suspensory ligament into the bladder, the point lifts with it the lax *urethra* in front of it, and, doubling it, forms a valve which blocks its further progress. Attention to keeping the whole length of the *urethra* stretched will generally prevent this, or it may be corrected by elevating the handle of the instrument so that the point disentangles itself, and will then pass on without hindrance. The point of the instrument is also not unfrequently stopped, by depressing the handle too early, that is, before it has completely entered the membranous part of the *urethra*, in which case it strikes against the front of the suspensory ligament, and will not pass further. The greatest care must therefore be taken that the instrument has passed well beyond the ligament before the handle is depressed and the point tilted up; and if then it will not enter the bladder without much difficulty, it is better to pass the finger into the *rectum*, and the end of the instrument being felt, it is in general easily directed into its proper course, and little risk encountered of thrusting it through the *urethra* between the bladder and *pubes*, or between the bladder and *rectum*, which, especially the latter, is of not unfrequent occurrence in not very practised hands. When the instrument has entered the bladder, its point can usually be freely moved in any direction; but when it will not move but forward after its handle is depressed, it is pretty certain it is not in the bladder but in a false passage, and must be withdrawn, and fresh attempts made to carry it in the proper direction, instead of thrusting about and doing serious mischief. The frequency of introducing the instrument must vary according to the irritability of the *urethra;* in some cases it cannot be used more than once a week at first, as it will frequently produce severe irritation in the passage, and be followed by shivering, and occasionally a hot fit afterwards, and it may be necessary to defer the second introduction for even a still longer period. But if no febrile excitement follow, it may be introduced every third or second day, which is generally often enough. It is also very advantageous to bathe the *perinæum* night and morning with warm water, and even immediately after the introduction of the instrument, if it have caused much irritation; and if there be continuing pain, it is best to apply a few leeches. Going into a warm bath twice a week, and the use of leeches to the *perinæum* as frequently, if the stricture be very obstinate, will be often found to assist very materially in hastening the introduction of the instrument, and the widening of the stricture. If the patient be desirous of keeping the passage free, he should persevere in passing a large bougie once a fortnight, long after the cure appears to have been effected, as there is always great tendency to its recontraction. Some Surgeons consider the introduction of a bougie is rendered more easy, by having its tip smeared with extract of *belladonna.* I have tried this plan, but I think not with much advantage. If any benefit be gained from it, it will not be immediate; the bougie thus smeared must be passed down to the stricture, and left in some hours, after which it must be withdrawn, and another introduced. It may, however, be doubted whether the mere residence of the bougie in the *urethra* has not more to do with the relief than the operation of the *belladonna;* for occasionally a bougie thus managed, as recommended by some French Surgeons, will facilitate the introduction of an instrument which previously would not enter the stricture. I do not like cat-gut, nor elastic gum-bougies; they are tough enough to do mischief, but not sufficiently firm to enable us to judge of the pressure made with them, nor to guide them properly.

I cannot say that my experience, as regards the wearing a gum elastic catheter for the cure of stricture, has been so successful as Brodie has found it. Frequently the irritation set up by it in both *urethra* and bladder has been so great as to compel its removal; and, although I think wearing a silver catheter is more easily borne, if the patient be kept in bed, which, under either mode of treatment, I have always found necessary to enjoin, yet even then I have known in one instance a slough of the *urethra* take place in front of the *scrotum*, without warning, in the course of a few hours; so that, although the case has seemed to be going on well at one visit, on the following day the first step towards a certain aperture in the *urethra* has been made.—J. F. S.]

1684. The time which the bougie should remain in the *urethra* must especially depend on the sensibility of the patient in general, and of the *urethra* in particular. It must be so managed that the patient shall suffer as little pain as possible. The bougie should, therefore, remain only till the patient complains of pain, which on the first day does not exceed a quarter or half an hour, but in an irritable *urethra* not longer than a few minutes. The introduction must be repeated about every other or every day. If the bougie be left in longer, severe pain, swelling of the testicles, febrile symptoms, and abscesses near the *urethra*, often occur. The use of the bougie must then be suspended for a long time, and the inflammatory condition got rid of by blood-letting, quietude, warm bathing, and antiphlogistic diet. Many writers have, however, advised that the bougie should remain for several days, in consequence of which an increased secretion of mucus in the *urethra* is excited, its sensibility blunted, and it is protected against the presence of foreign bodies (*a*). For the most part, patients soon become accustomed to the longer resting of the bougie in the *urethra*, and after some days it may be left. It is then advisable to exchange it for an elastic catheter, which is specially indicated, if there be already fistulous openings, because the patient is thereby relieved from the necessity of its frequent removal, and re-introduction, for the purpose of discharging his urine.

The bougie, or catheter, when left in, should be properly fastened; a tape must be bound tightly round it at the mouth of the *urethra*, the ends of which, carried over the *glans penis*, must be fastened behind it with several turns of sticking plaster, and the loose ends tied together. This mode of fastening is simple, safe, without difficulty, and preferable to fastening a thread to a ring placed upon the *penis*. (DUPUYTREN.)

When the bougie has been long left in, it often, specially at first, acquires an indent from the stricture, in consequence of which, if it be carelessly withdrawn, violent pain may be produced. This may be prevented, if the bougie be frequently moved, and gently drawn up and down.

1685. Thin bougies, or catheters, should be gradually exchanged for thicker ones, which, in not very tough strictures, may be soon; and this should be repeated till the urine is voided in its accustomed stream. The bougie must not be left off at once, but must still be left in for some time every day, or every other day, and afterwards every week for some hours. It will be also advantageous in dispersing the hardness of the membranes of the *urethra* to apply, externally, mercurial ointment, and to give, internally, cherry bay water (*b*) and the like.

If, afterwards, the stream of urine should begin to diminish, and the patient have difficulty in passing it, the use of the bougie must again be prescribed.

In order to effect the expansion of the stricture at pleasure, ARNOTT (*c*) has proposed an instrument, consisting of an oiled silk tube, which, for the purpose of rendering it air-tight, is lined with the thin gut of some small animal, and connected with another tube, through which air can be blown, or water injected by means of a syringe, and retained by a cock. Although the introduction of this instrument is generally as easy as that of a bougie, it is, however, frequently, better, especially in an irritable *urethra*, to introduce it through a canula. When it has penetrated the stricture, it is to be filled with air or water, as long as the patient can bear it without pain.

[Conundrums of this sort are very well pour s'amuser, but every practical person will be very well aware that if a stricture will admit such a contrivance it is sufficiently expanded not to require the assistance of a Surgeon, or any one else, but had better be left alone.—J. F. S.]

1686. The operation of bougies consists in the expansion, compression, and irritation, produced by their introduction and inlying, in consequence of which an increased secretion of mucus, and modification of the vitality and condition of the diseasedly changed mucous membrane is set up. In common cases their presence in the *urethra* excites only a little pain and mucous discharge; but in sensitive persons, violent pain and inflammation, painful erections, transition of the inflammation to the testicles, and swelling of the inguinal glands, will be produced with the inlying of the bougie; also inflammation of the cellular tissue upon the outer surface of the *urethra*,

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(*a*) DESAULT, CHOPART, DELPECH, Précis Elémentaire, vol. i. p. 558.

(*b*) RICHTER, Anfangsgründe, vol. vi. p. 283.

(*c*) Above cited, p. 92.

terminating in suppuration and extravasation of the urine. All these symptoms require, besides the removal of the bougie, an antiphlogistic treatment corresponding to circumstances, blood-letting, spare diet, lukewarm bathing, and the like. If, during the use of the bougie, an abscess form, with severe pain increased on pressure, DESAULT (*a*) advises the introduction of an elastic catheter, not to open the abscess, but to let it burst of itself, or, if it empty into the *urethra*, to let the pus escape by the catheter; but if it be then necessary, on account of the great size of the abscess, to open it, then always to make a small opening, as a large aperture retards the cure. Although, however, I have in several instances pursued this treatment successfully, yet it appears better, on account of the danger from extravasation of urine, in these cases, as soon as inflammation shows itself, to remove the bougie, and to employ active antiphlogistic treatment by general and local blood-letting, bathing, softening poultices, rubbing in mercurial ointment, and the like, and if fluctuation should show itself, by early opening the abscess (*b*).

[ASTLEY COOPER adverts to the not unfrequent circumstances of bleeding from the *urethra* after the introduction of the bougie; or, it may be added, of a sound or catheter which has been roughly handled, or after the use of a caustic bougie. He says:—"The passing of a bougie is often attended with very considerable hæmorrhage from the *urethra*," and mentions a case in which he "pressed a roller upon the *perinæum*, which instantly checked the flow of blood. A short time after he was sent for to the same patient, the hæmorrhage having returned; he had been lounging before the fire with a foot on each side of the chimney-piece; the warmth coming in contact with the *perinæum*, had brought on a renewal of the hæmorrhage. He made an incision on the part, and divided the artery of the bulb; this operation completely succeeded, and the bleeding was permanently subdued." (p. 225.) I apprehend the necessity for such active treatment is rare, at least I have never seen any need for it, and believe that ABERNETHY'S mode of proceeding (*c*) is amply sufficient in most cases. "When hæmorrhage occurs it is best," he says, "to put the *penis* in a tumbler, so that the quantity of blood may be evident. I cover the feet and upper part of the body with the bed-clothes, leaving the *pelvis* bare; I then wash the *perinæum* with vinegar and water. The vessels of the *urethra* speedily contract, and the bleeding stops. I would recommend you to do these things yourself, and not trust to the patient or his attendant."

ASTLEY COOPER also gives the following advice, which, if followed, will often save the patient much suffering:—"Whenever you suspect a tear of the *urethra* in passing a bougie, immediately withdraw the instrument, and desire the patient, if possible, to retain his urine, that it may not irritate the wound, and also to prevent it escaping through the opening and becoming extravasated in the surrounding cellular substance. In this way you give time for a clot of blood to form over the surface of the wound, a slight degree of inflammation is excited, and it becomes healed by the adhesive process without any further mischief." (p. 225.) To this I would add that, under such circumstances, it is advisable that no attempt should be made to introduce the instrument again for several days, and that it should then be done with a very light hand, and with great care.—J. F. S.]

1687. The *destruction of stricture by caustic* is effected either with *nitrate of silver* or *caustic potash*. The application of both these remedies varies, according as the cauterization is made upon the stricture from before backwards, or on its walls in the narrowed part itself.

The destruction of strictures by *ulceration*, in which very hard bougies are violently inserted in the stricture, so that they are grasped by it, in order to produce compression and ulceration of their walls, is to be completely rejected as dangerous and unsafe.

[BRODIE says:—"I am much mistaken if a stricture is not sometimes destroyed, at least in part, by ulceration. For example: I attended a gentleman who had laboured under a stricture of the *urethra* for a great many years. He voided his urine with the greatest difficulty, the stricture being very rigid and unyielding; but I succeeded in introducing a cat-gut bougie, and this enabled him to make water in a small stream. Under

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(*a*) Above cited, p. 252.

(*b*) DUCAMP, above cited, p. 87.

(*c*) MS. Lectures.

these circumstances he was seized with pain in the act of making water, which lasted for some minutes afterwards, being referred to the situation of the stricture in the posterior part of the *urethra*. The pain became more severe, and the patient described it to be intolerable, saying that he could compare it to nothing but the sensations which he supposed would be produced if melted lead had been poured into the canal. Every half hour he had a desire to make water, and his groans might be heard, not only through the whole house, but even in the street. In the course of a few days these symptoms began gradually to abate, and now it was discovered that the urine flowed in a much larger stream. When the attack had completely subsided, the condition of the patient was much improved, and he made water more easily than he had done for many years." (p. 15.)]

1688. In *cauterizing a stricture from before backwards*, a common bougie is to be first carried down to the stricture, for the purpose of opening the canal of the *urethra*, and the distance from the orifice of the canal must be marked close to it on the bougie. This having been withdrawn, a corresponding mark is to be made on a bougie armed with lunar caustic, which, after having been properly oiled, must be carried down the *urethra* to the stricture, against which it must be moderately pressed, and according to the patient's feelings, for a different length of time, though on the first day not for a minute. In this way the armed bougie is employed every other day, or in obstinate cases, daily. When the slough has been thrown off, an elastic bougie is to be introduced, and thus gradually the natural calibre of the *urethra* is restored.

Bougies armed with lunar caustic are made in the following way:—In forming the common bougie a piece of wire is rolled into it, extending about half an inch into its substance. When the bougie is nearly completed, the wire must be pulled out, and a piece of lunar caustic inserted in its place. The bougie is to be then again rolled, so that the sides of the caustic may be firmly surrounded with the linen, which gives a blunt end to the bougie.

Hunter (*a*) used, for applying the caustic, a flexible silver catheter, provided with a stilette, which had at its extremity a portcrayon for holding the caustic.

[In the directions which Hunter gives for the introduction of the caustic, he mentions, it is necessary for the canula to be furnished with a piece of silver or a stilette, having a button at one end, forming a kind of plug, which should project beyond the end of the canula, and give it a rounded end, to facilitate its passage along the *urethra* to the stricture, having reached which the plug is withdrawn, and the portcrayon, which may be attached to the other end of the stilette, introduced in its stead. This apparatus was, however, a very bungling contrivance, and Hunter doubtless found it so, for Home mentions in a note, "that before his death Mr. Hunter left off entirely the use of the silver canula, and used the lunar caustic inserted into the end of a common bougie," (p. 140,) the mode in which it is now, whenever employed. The great advocate for the treatment with lunar caustic was Home; but it was soon fiercely and efficiently attacked by Whately, who shewed the mischievous and dangerous results ensuing from it; for, to use Lawrence's words, "if we are to credit the description which Home gives, nothing would be more safe or effectual than this mode of treatment. When we come, however, to peruse the cases he gives in illustration of the various points of the treatment, we find that serious mischief is sometimes produced by this mode of treating stricture; and as he (Home) is highly favourable to the plan, we may at all events suppose that he has not exaggerated the ill-effects of the treatment." (p. 802.)]

1689. This mode of cauterization has considerable objection, as especially in strictures behind the curve of the *urethra*, the walls are easily destroyed, false passages made, and considerable bleedings produced. Not unfrequently the aperture of the stricture is closed by the thick slough, and complete obstruction to the voidance of the urine produced: and further, by the hard, formless scar which is produced, the disease again returns more severely than at first.

1690. It is attempted to overcome the greater number of these dis-

(*a*) Above cited, p. 139.

advantages by *cauterizing the walls of the stricture.* According to Arnott (*a*), after the seat and condition of the stricture have been ascertained by careful examination, and with a very soft bougie, which should be introduced through a canula, and take every impresion of the stricture, a pretty large canula should be carried down to the stricture. A piece of lunar caustic, somewhat smaller than the stricture, should then be pierced through its middle with a metal stilette, and upon which it must be retained, half an inch from the tip, so that the stilette may be surrounded with a piece of common bougie, both in front and behind the caustic. The stilette is then passed through the canula down to the stricture, and through it, so that the caustic can be applied to any part of the stricture. When the caustic has been properly used, a small wad of linen is to be introduced by means of the same stilette and canula, to sop up all the caustic which has become fluid.

[It must not be supposed, as Chelius would seem to infer, that Dr. Arnott is the original proposer of the treatment of cauterizing the walls of the stricture with lunar caustic; for Whately, in his *Observations on Mr. Home's Treatment of Strictures, &c.*, published in 1801, eighteen years before the first edition of Arnott's book on *Stricture*, had mentioned among the advantages of his construction of caustic bougies, by gluing the end of the instrument, and applying it to a given quantity of powdered lunar caustic, that "in the first place, the bougie may be of any size, even the smallest size can by this method become the vehicle of this powerful remedy; and *may be readily passed into, or a little beyond, such strictures as are extremely narrow;* or such as are attended with considerable contraction of the orifice of the urethra." (p. 68.) And again:—"If the stricture be open enough to admit a bougie of moderate size, such *a bougie armed with caustic may very readily be passed into or beyond it.*" (p. 72.) Perhaps Dr. Arnott was unaware of Whately's observations, for it is rather curious, that although Hunter, Home, Astley Cooper, Lallemand, Ducamp, and other writers on stricture are mentioned by him, the only notice taken of Whately is, that a naval captain had obtained considerable relief under his care; and that after his death the captain's stricture having returned, he placed himself under the care of other Surgeons, but without receiving much benefit from their treatment. He at length, in 1824, consulted Dr. James Arnott, who employed the dilator invented by him, from which he obtained considerable relief. (p. 111, *note.*) Dr. Arnott's new method is precisely the same as John Hunter's mode of using the lunar caustic, and which he gave up as inefficient, with the exception that the caustic is held on a piece of wire, by which it is pierced, instead of a portcrayon, as in Hunter's mode; and with the important addition, that the stilette of the plug, instead of having the portcrayon attached to the other end, as recommended by Hunter, has "a little dossil of lint fixed on it, which is introduced before the caustic, to absorb any superfluous moisture in the stricture, and after it again, to take up any dissolved caustic which might spread in the canal." (p. 158.) From the above extracts it appears that the proposal of cauterizing the interior of the stricture, whether of much value or little, is Whately's and not Arnott's; nor the new method other than John Hunter's old and disbanded one, with the addition of a wipe.—J.F.S.]

1691. If caustic potash be used for cauterizing the walls of the stricture, a bougie of sufficient thickness to enter the stricture with difficulty must be chosen, and passed down to it. A mark is then made on the bougie with the nail, half an inch from the orifice of the *urethra*, and when it has been withdrawn, a little cavity about the twelfth of an inch deep must be made in its rounded end, into which a small piece of caustic, less than the smallest pin's head, must be put, and so pressed in that the edge of the cavity project a little beyond it. To fix the caustic, the bougie must be squeezed together with the fingers, and the interspace filled with lard. Thus armed, and after having been well oiled, the bougie is carried down the *urethra* to the stricture, where it is to be held till the caustic begin to become fluid, and the patient feels a burning pain. It is

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(*a*) Above cited, p. 157.

then to be introduced a quarter of an inch farther into the stricture, held there about a couple of seconds, and then passed a little further, till by a peculiar feel, or by the approach of the nail-mark to the lips of the *urethra*, it appears that the bougie has penetrated the stricture. If no pain occur, the bougie should be introduced once or twice a day; but if there be pain, it must not be used. The whole operation should not exceed two minutes. Generally after the first use of the caustic there is but little pain, a slight cutting in making water, and its discharge in drops during the first few days. The bougie used should correspond to the diameter of the stricture, the caustic repeated after every eight days, and the bougie increased in size till the natural size of the *urethra* is attained.

[The use of caustic potash in the treatment of stricture, was also first practised by Whately (*a*). "It has, however," says he, "been my good fortune to discover a more efficacious, and, at the same time, a less painful and hazardous remedy (than lunar caustic) for the disease in question. This valuable remedy is the *kali purum*, which, if used in the manner, and with the precautions shortly to be described, will be found of singular efficacy in removing the complaint." (p. 23.) The directions for preparing the bougie, and its mode of use, are those above given by Chelius. Upon this mode of treatment Lawrence observes:—"Mr. Whately seems to have been as cautious in the employment of this substance, as Sir Everard Home was bold in his use of lunar caustic, for he recommends you to take a fragment of *potassa fusa*, not larger than the *seventeenth part of a grain*. And he says he never used a portion larger than the twelfth of a grain. * * * I should conceive, according to the description Mr. Whately has given of it, that it is just capable of doing that good which the simple introduction of a plain bougie can effect; and I cannot think it had any effect whatever as an escharotic." (p. 802.)]

1692. Although these two modes of cauterizing the interior of the stricture have considerable advantage over that of cauterizing from before backwards, yet they have little certainty in practice, and in many respects are deficient, especially the caustic potash. Ducamp has the great credit of having proposed a method of cauterization and destruction of stricture, which is distinguished from all the previous modes by its accuracy and certainty.

1693. According to Ducamp's method, the seat of the stricture is first found with a bougie or sound, and the situation and condition of its aperture ascertained by an exploration-sound, the end of which is covered with modelling wax, which being gently, but steadily pressed against the obstacle, a perfect impress of the stricture is obtained. Its length is also determined by a thin bougie, with a little bulb, and covered with modelling wax, which is fastened to a thicker conductor. For this purpose Charles Bell has recommended a thin metallic sound with a button, Arnott a thin tube, with a very short leather button, and Amussat (*b*) an explorer. For this object Ducamp has proposed a peculiar instrument, which, however, does not appear suitable. It is oftentimes necessary, to enlarge somewhat the very narrow opening of the stricture by gradually thicker bougies, which may be left in half an hour.

1694. The cauterization is performed with a caustic-holder, which, being properly oiled, is carried down to the obstacle, and then its inner shaft made to describe a half circle, is protruded into the stricture. For the purpose of cauterizing the whole surface, the instrument is gently turned on its axis. After a minute the inner shaft is to be drawn back into the canula, and the instrument taken out. If the ridge formed by the

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(*a*) An improved Method, &c., above cited.

(*b*) Above cited, pl. i.

stricture be at the upper or under part, or on either side of the *urethra*, which is shown by the impression on the exploration sound, the caustic must be directed to that spot.

A small piece of lunar caustic is to be put into the inner shaft of the caustic-holder, and the flame of a wax taper directed upon it with a blow-pipe; the caustic soon melts, and completely fills the whole groove. The heat must not be too great, or it will swell up the caustic; it must only be sufficient to fuse it. If any points project, they must be removed with pumice stone. The groove will hold about half a grain of lunar caustic, and, if the instrument be kept in not longer than a minute, about one-third of it will dissolve. As by this method the caustic will be easily too much swollen up, and little remain in the groove, HAHN, according to BERG, proposes the following method:—Some powdered lunar caustic, from six to twenty grains, is to be moistened with water in a little porphyry dish, boiled up over a spirit-lamp, and constantly stirred with a silver knife till the water have evaporated, and the caustic remain fluid in its water of crystallization alone, which may be ascertained by its thin pap-like appearance, and the formation of the crystallization-film. This paste is now to be spread with the spatula on the slightly-heated groove of the shaft, and, when it has cooled, any projection is to be removed with the spatula, or with pumice stone. Whilst boiling, the caustic flies about smartly, and therefore it is necessary to put on a glove, so that the hand be not spotted with black.

1695. If there be only a single stricture, the patient feels, on the day of cauterization, little pain, but without passing his water in a larger stream; on the third day the slough separates, and the stream is then increased. The pain caused by the cauterization is scarcely more than that produced by the introduction of a common bougie. No inflammation occurs; very rarely a discharge, and, if previously existing, it is stopped.

1696. After three days a new impression is to be taken with the exploring sound, which shows how much the opening has increased, and what part still projects, and must be destroyed. A moderate-sized bougie must then be passed and carried into the bladder, to ascertain that there is not another stricture. The caustic is now again to be applied as before, and at the most prominent part. Three days after a third impression is to be taken, and if the parts forming the obstacle project little, and a bougie, No. 6, can be passed with ease, the enlargement of the canal has commenced. If there be still any prominence, or if the bougie pass with difficulty, the caustic must be applied a third time. If there be a second or third stricture, it is to be attacked in one or other of these ways.

1697. For the purpose of keeping the scar as wide as the *urethra* in its natural state, DUCAMP employs peculiar *dilators*, and *bellied bougies* (*bougies à ventre.*) Three days after the last cauterization, a dilator of three lines diameter is introduced, inflated with air, and left in not longer than five minutes. Next day the same dilator is passed, expanded with air or water, and after ten minutes withdrawn and replaced by a bougie of two and a half lines diameter, which is left in for twenty minutes. This bougie is to be introduced for the same time next morning and evening. On the following day a dilator of four lines diameter is to be passed, withdrawn after ten minutes, and replaced by a bougie of three lines, which also, on next morning and evening, is to be left in from fifteen to twenty minutes. Two days after a dilator of four and a half lines is introduced, and afterwards a bougie of four lines morning and evening, each time for a quarter of an hour. After thus proceeding for a week, the bougie is only to be passed once a day, and allowed to remain for a few minutes; for the following four or five, the bougie is to be introduced once daily, and withdrawn immediately. The scar is then well consolidated, and is four lines in width, as in the rest of the urethral canal. **Ducamp** (*a*).

Dubouchet (*b*) thinks that the bellied bougies, will do as well as the dilators; and, indeed, experience proves it to be so.

1698. **Ducamp** cautions against the application of caustic when the *urethra* is inflamed; that in long strictures it is best to destroy them bit by bit, by applying it only for two or three lines, as a longer slough separates with more difficulty, and the canal may be stopped up. If the stricture be six inches distant from the orifice of the *urethra*, a curved caustic-holder should be employed. As **Ducamp**'s instrument will admit of no twisting, and as, on account of the different dimensions of the *urethra*, the cauterization, even up to six inches, cannot always be performed without danger of making a false passage, so **Lallemand**, **Amussat**, **Segalas**, and **Tanchou** have proposed modified caustic-holders, which may be introduced into the stricture with greater certainty.

For the enlargement of very narrow strictures, **Lallemand** uses catgut. As the use of the exploring bougie, with however great care, in many instances produces great pain, and often much bleeding, and some of the wax may get loose, and by stopping up the canal cause retention of urine, **Lallemand**, if the impression of the stricture be not absolutely necessary, introduces a bougie smeared with wax into the stricture, which, after some time being withdrawn, by the pressure it has suffered. shows the length and even the situation of the obstacle. By the caustic bougie a second and third stricture may be attacked before the first is perfectly removed. **Ducamp** says that caustic should not longer be employed after a bougie No. 6 passes easily over the obstacle. **Lallemand**'s experience shows that in such cases it is better to cauterize again, than to persist in the enlargement, if changing to a larger sound cause pain. **Lallemand** does not agree with **Ducamp** in destroying long strictures bit by bit, but advises cauterizing their whole length at once, as he has never noticed complete retention of urine in such case, nor even in that of deeper strictures from the separation of the sloughs; and, even should it occur, it might be easily relieved by the introduction of a bougie. **Lallemand** considers the subsequent widening of the *urethra* by dilators useless; the bellied bougies will not easily take the necessary bend so as to be carried over the crooked *urethra*, which however I must, from experience, contradict. Elastic curved sounds or bougies are most effective, which should be left in for fifteen or twenty minutes, and should not go beyond the width of Nos. 11 and 12, as if they pass, we may be quite sure of a successful result.

Amussat employs both straight and curved caustic-holders (*c*).

Segalas' caustic-holder is distinguished by its introduction, covered, into the stricture. It consists of a graduated gum elastic catheter, in which a canula serves the purpose of sheathing the stilette of the caustic-holder, which, with its olive-shaped button, fits close to the mouth of the canula. The instrument is passed down to the stricture, then the canula carried down it, and, being withdrawn, leaves the caustic-holder uncovered in the stricture.

Tanchou's caustic-holder, by means of a projecting stilette, is more certainly introduced into the stricture, and the formation of a false passage thereby prevented. It consists of a graduated elastic catheter, with a niche for the reception of the caustic, which is placed on a metal shaft, having its extremity spiral, so that it may be more flexible and more readily applicable to the curves of the *urethra*, and of a silver or gold stilette, which is conveyed through the sheath of the instrument, and also guides it in passing forwards into the stricture (*d*).

1699. Opinion is still very much divided as to the preference of the treatment of stricture by bougies, and their destruction by caustic. It must be borne in mind, however, in making the comparison, that the mischief usually assigned to the destruction of strictures by caustic, has occurred only by the use of armed bougies, (*par.* 1689,) but not since the improved method of **Ducamp**; by which it is believed that there is greater

(*a*) Above cited, pl. i. to iv.—**Froriep**, Chirurgische Kupfertaf., pl. lxxxi.

(*b*) Nouveau Traité des Rétentions d'Urine, p. 206. Paris, 1834. 8vo.

(*c*) Above cited, pl. iii iv.

(*d*) Above cited, pl. i. f. 1, 2, 3.

certainty in the application of the caustic, and that the cure is quicker and more constant than by dilatation; that the pain is less as experience proves; that the hardened part which forms the stricture is very little sensitive, and that in the cauterization there is only pain when the sound part of the *urethra* is touched with the caustic. These circumstances are the more weighty, the older and tougher the strictures are, as only in recent cases, and when the stricture is easily extensible, and especially if short, can they be soon cured with the dilator. In strictures which are very close, and also not very long, dilatation may, indeed, be of some service, but the cure is very tedious, and not so radical as by cauterization. The preference given to bougies, because long, and several strictures can be treated together, applies equally well to the improved modes of treatment with caustic. Also in great sensibility of the *urethra*, in which the presence of a bougie can well be borne, and the above-described symptoms (*par.* 1686) are to be dreaded, the sensibility is often much blunted by cauterization. These advantages, however, even in the best modes of applying caustic, are not to be received as general and unconditional; for even with them severe inflammatory symptoms and false passages may be produced, especially if the stricture be seated at the hind part of the *urethra.* The rapidity with which cauterization brings about the cure, is counterbalanced by the transient nature of its result, as the seat of the scar in the *urethra*, after complete subsequent dilatation, has always a decided disposition to contract, by which the most stubborn form of stricture is produced. I have seen in many instances, and even in patients who have been cauterized by Ducamp himself, relapses, the cure of which was exceedingly difficult. Although the dilatation with the bougies is more tedious than cauterization, yet I must assign to them the greater certainty of a permanent cure. But after the natural width of the *urethra* has been restored the introduction of bougies must be repeated from time to time; and it must be especially noticed that in a stricture, which has been many years forming, and has been of long continuance, the canal of the *urethra* is not in the course of a few weeks to be restored to its natural condition. It is especially not attending to these circumstances, that in dilatation, lays the foundation of relapses. Only in very old hard strictures, in which dilatation cannot be effected, or is very painful and intolerable, do I consider cauterization to be indicated.

Also in fungous degeneration of the mucous membrane of the prostrate gland, which occurs in long-continued strictures (*par.* 1675) when, besides a copious secretion of *mucus*, a sort of fleshy lumps is discharged with the urine, and the urethral canal is not narrowed. Lallemand (*a*) has touched every degenerated mucous membrane with his sound in order to decide on its vitality.

[Upon the employment of caustic in the treatment of strictures Astley Cooper says:—"The use of caustic has certainly been very much abused, and in many instances has produced the very worst consequences, and I would say that it never ought to be employed, except where the stricture is accompanied with fistula *in perinæo*, and that fistula behind the stricture; then there can be no apprehension of the caustic occasioning retention of urine, which it has done when injudiciously employed." (p. 224.)

Brodie observes:—"I very rarely use the armed bougie in my own practice, and I never resort to it in the first instance. My reasons for preferring the other methods of treatment, in ordinary cases, are these:—*first*, although the caustic often relieves the spasm, it also very often induces it. It is true, that in many instances it enables a patient to make water with more facility; but in many instances, also, it brings on a retention of urine; *secondly*, hæmorrhage is a more frequent consequence of the use of the caustic than of the common bougie, and it sometimes takes place to a very

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(*a*) Above cited, p. 76.

great and to an almost dangerous extent; *thirdly*, where there is a disposition to rigors, the application of the caustic is almost certain to produce them; and frequently the application of the caustic induces rigors where there had been no manifest disposition to them previously; *fourthly*, unless used with caution, the application of caustic may induce inflammation of the parts situated behind the stricture, terminating in the formation of abscess. I have known some cases of abscesses formed under these circumstances, which, from their peculiar situation, have proved more troublesome and more difficult to manage than the original disease." (pp. 61, 2.)

Upon the same point Lawrence says:—"From the various results which attend the free employment of caustic in the *urethra*, I think that we may safely say it is a mode of treatment not applicable to bad cases of stricture; that is, cases where the change of structure is considerable, and the contraction is very extensive; and in cases not so serious we know that the application of caustic is not necessary, for the simple bougie, sound or silver catheter, will accomplish the object we have in view. The use of caustic has, in general, been very little favoured on the continent; they have generally healed strictures there without it, and have been averse to it from knowing its ill effects; it has been partially employed in this country, but never got into very great use, and I believe has been generally less and less used, so that at present it is but seldom adopted in the treatment of stricture of the *urethra*." (p. 802.)

With these opinions, as to the disadvantage of using caustic, I fully concur; and I rarely employ it in treating strictures. Another reason may also be given against it, which is, that though for a time, that time only, however, when the slough of the cauterized stricture has been thrown off, and the part is still sore, it may enlarge the passage of the *urethra*, yet as the sore surface heals a new and closer scar is formed, by which the previously narrowed passage will be necessarily rendered still smaller. Every young student knows the common mode of contracting apertures in the soft, and even in the hard palate, by producing sloughs of their margin, with the certain knowledge that the subsequently forming scar will diminish the size of the hole, and that a repetition of the same practice will at last completely obliterate it. And the result must be the same by its application to a stricture, although at first there may be a seeming improvement. I must confess I cannot understand the reason why, although objecting to the use of caustic under other circumstances, Astley Cooper allows it when there is perinæal fistula.—J. F. S.]

1700. *Cutting into the stricture*, and subsequent dilatation, has been also recommended for its more speedy removal; and for this purpose various modes of proceeding have been advised. The older Surgeons used the trocar and the pointed sound (*a*). Doerner (*b*) recommended a tube through which a stilette, with a lancet point, should be passed, Dzondi (*c*) a catheter open at its end, through which a lancet-shaped knife could be carried forwards and backwards; and in like manner also McGhie (*d*), Amussat (*e*), Despiney (*f*), Dieffenbach (*g*), and Tanchou (*h*). These modes can only be employed with safety in short and not very tight strictures. The proper use of bougies and caustic certainly render it unnecessary, and it can only be considered as indicated when neither dilatation nor repeated cauterization have any result, when the stricture remains hard, and the *urethra* does not acquire its natural calibre.

Jameson (*i*) seeks for the causes of stricture in an unnatural contraction of the transverse fibres of the *m. accelerator urinæ*, at its fore part, which cross the *urethra* at right angle, as well as of the same part of the *m. levator ani*, in contact with the *urethra*. For the radical cure of this disease, he cuts through the just-named parts, partly through the *penis*, and partly through the *perinæum*.

(*a*) Lafaye and Vigueri; in Chopart, above cited, vol. ii. p. 328.—Allies, Traité des Maladies de l'Urètre. Paris, 1755. p. 73.

(*b*) Vorschlag eines neuen Mittels, hartnäckige Harnröhrenverengerungen leicht und aus dem Grunde zu heben; in von Siebold's Chiron., vol. i. p. 259.

(*c*) Geschichte des klinischen Institutes für Chirurgie und Augenheilkunde zu Halle. 1818. pl. ii. f. 1–3.

(*d*) Edinburgh Med. and Surg. Journal, vol. xix. p. 361, 1823.

(*e*) Above cited, pl. ii.

(*f*) Archives générales de Médecine, vol. xi. p. 146. 1826. May.

(*g*) Hecker's allgem. litt. Annalen, p. 165, 1826. The cut should be made from behind forwards. Proper instruments for the dilatation are recommended.

(*h*) Above cited pl. ii.—Stafford, On Perforation and Incision of Permanent Stricture of the Urethra by the Lancet Stilettes. London, 1836. 8vo. Third Edition.

(*i*) Medical Recorder, 1824, April, p. 251.

Upon breaking through strictures with the conical catheter, refer to Retention of Urine (*par.* 1813.)

1701. In stricture of the *urethra* behind the bulb, especially if a hard, stiff bougie be used, if with it, or with a catheter, force be employed, or if there be abscesses near the *urethra*, its walls may be easily torn, and by the entrance of the catheter or bougie, a *false passage* formed either in the spongy substance of the *urethra* or in the space between the bladder and the *rectum*. This is easily perceived when the instrument is pushed forwards, with much pain, and on its withdrawal, which is done readily, no urine, but only blood flows out. This false passage, in most instances, renders the introduction of a bougie or catheter difficult or impossible, because they always run into it. The careful impress with DUCAMP's exploring sound, and the introduction of a straight bougie or sound, or the application of caustic with LALLEMAND's sound, in the proper direction of the *urethra*, may render the introduction of the catheter possible.

If this cannot be done, and infiltration of urine occur, the following must be the treatment. A sound must be passed into the *urethra* as deep as possible, and a cut made from without towards its point, which will certainly be found behind the stricture. If the false passage be between the *urethra* and the body of the *penis*, the *urethra* will be laid open, the point of the sound having been first bared. A sound is to be introduced into the opened *urethra*, thrust towards the *glans*, and the stricture broken through; or two sounds must be introduced, one by the mouth of the *urethra*, and the other by the wound to the stricture, and pressed together in the proper direction, for which purpose a pointed sound is best; and thus the stricture is penetrated. An elastic catheter is then introduced from the opening of the *urethra* in the wound, and carried into the bladder. If the false passage be between the *urethra* and the external skin, the cut must be made through the latter upon the sound, the *urethra* opened, and an elastic catheter introduced. The treatment of the wound is to be conducted according to the rules already laid down (*par.* 965.)

[I cannot agree with the method, here recommended by CHELIUS, of passing the sound into the bottom of the false passage; for, if this be done, there will be considerable difficulty in finding the *urethra*. The instrument should be carried down *only to the stricture*, and then its point cut upon; which done, the stricture must be cautiously cut through, from before, backwards in the mesial line, by little and little, and the *urethra* behind the stricture continually sought for with a probe's point, the patient being at the same time directed to strain, so as if possible to force out urine, the point of escape of which will afford a guide to the exact track of the *urethra*. Much caution is requisite, that the *urethra* be not completely cleft, and the suspensory ligament deeply cut into, by which the difficulty in discovering the *urethra* is considerably increased. This is an accident to which young and not much practised operators are very liable to fall, and be sorely hampered by. The division of a stricture, and the re-connexion of the two portions of the *urethra* by a catheter, is generally an operation of difficulty under the most favourable circumstances, but when the neighbourhood of the canal has been ploughed up with false passages, the difficulties are considerably increased. It may be well to mention, that the first cut should be made in the *raphe*, and the whole operation continued in the mesial line; and I do not think any material damage is done by cutting through the bulb of the *penis*, which, indeed, is often absolutely necessary, although some practitioners imagine that the generative functions of the organ are thereby interfered with, to which, however, I do not assent.—J. F. S.]

1702. When the *urethra* is closed, as a vice of the first formation, there is either only a superficial membranous closure of its mouth, or the growing together may be deeper situated. In the *former* case, the prepuce is to be drawn back over the *glans*, till the tip of the *glans* is exposed, and then a lancet thrust in, with its edges upwards and downwards, through the closing membrane, and reunion prevented by the insertion of a piece of linen smeared with oil, or of a piece of bougie. In the *latter*, a thin trochar must be pushed in, according to the direction of the mouth of the *urethra*, till it enter the canal, which must be kept open by introducing a piece of bougie; or, if this cannot be done, the *urethra* is to be opened where the collected urine bulges it out. I was obliged to do this in an accidental case of growing together of the urethral orifice, arising from a destroying venereal ulcer, in which there was not the least trace of an aperture in the hardened part to be discovered.

When the *urethra* opens at some distance from the *glans (Hypospadias)* it will be necessary for the relief of impotence consequent thereon, to perforate the *glans* with a trocar up to the false orifice, to introduce a canula, and to heal up the lower opening, which must be previously scarified. It is rare that this union can be effected, which, however, does not always frustrate the object of the operation, as the discharge of the *semen* through the new aperture will take place. According to WALTHER (*a*), the closure of the lower aperture should not be at all cared for. It has also been advised, if this operation do not succeed, to cleave the *glans* from the *urethra* up to its very tip, and to heal the wound over a tube introduced for the purpose, or to cut off obliquely a piece of the *glans* from the false urethral orifice to its tip. The cases, however, are rare in which this degree of misformation becomes the cause of impotence. In one case, a child in whom the *urethra* opened at the root of the *penis*, DUPYUTREN (*b*) formed, by means of a thin trochar, a new canal, which he cauterized throughout its whole length with the actual cautery; and after the severe inflammatory symptoms had passed by, and the slough had been thrown off, he kept it open with an elastic sound. The fistula closed.

XI.—OF CLOSURE AND NARROWING OF THE VAGINA.

1703. *Closure of the Vagina* (*Atresia Vaginæ*, Lat.: *Verschliessung der Mutterschiede*, Germ.: *Imperforation du Vagin*, Fr.) may be either a vice of the first formation, or may occur subsequently by its growing together. In the *former* case it may depend on union of the *labia* and *nymphæ* throughout their whole extent, in the midst of which commonly a white line is perceived, through the *hymen*, which has no aperture, and is also both firmer and tougher, or by a similar membranous closure more or less high in the *vagina*, or the passage of the *vagina* is closed by a fleshy mass. In the *latter* case, the closure of the *vagina* is the consequence of a growing together which takes place after ulceration and wounds of its walls.

1704. If in congenital closure of the *vagina*, the orifice of the *urethra* be not also closed up, it is rarely discovered before puberty. Then as menstruation comes on there is pain in the back, pressure, straining, weight in the genitals, fullness of the belly, frequent urging to void the urine, sometimes complete retention, difficulty in going to stool, and the like, and no menstrual discharge appears. These inconveniences at first appear monthly, and subside; but at last, when the collection of the blood is considerable, they no longer subside, but increase every month, and general symptoms appear also, anxiety, pale countenance, pain in the belly, faintness, loss of sleep, labour-like pain in the genitals. If the collected blood can find no outlet, it gradually increases in quantity, so that it distends the womb, and empties itself by the Fallopian tubes into the cavity of the belly, or menstruation may be set up in some unusual way. Local

(*a*) Salzb. Med.-Chir. Zeitung, vol. i. p. 188. 1813.

(*b*) SABATIER, Médecine Opératoire. Nouv. Edit. par SANSON et BEGIN, vol. iv. p. 435.—DIEFFENBACH; in Hamb. Magaz. der Ausl. Liter., vol. iv. part i.

examination always readily discovers the closure of the *vagina*. When this depends on the *hymen*, or on a mere skin, it is always distended like a sac, by the collected blood, descends and fluctuates.

1705. The narrowing of the *vagina* extends either throughout its whole length, or is confined to one part. In the *former* case it depends on an arrested development of these parts ; in the *latter*, is usually the consequence of injury of the *vagina* with loss of substance, in difficult labour, in which a part has been destroyed by gangrene, and the scar contracts the canal, or bands are formed which cross the *vagina*, or partial union of the passage takes place. There are sometimes one or several small holes in the membrane closing the *vagina*, or the *hymen*, although pervious is unusually tough. According to the degree of narrowing various symptoms may be produced, as obstructed menstruation, pain in connexion, and the like. Although the complete introduction of the *penis* into the narrow *vagina* be not possible, yet pregnancy may occur.

1706. The *cure* of the closure of the *vagina* consists in opening it to such extent that it can perform its functions, and in preventing its reunion. This operation is more or less difficult, according as the closure is at the orifice or higher up in the *vagina*, as it is thinner or thicker, or more or less extensive. The prevention of reunion is often attended with considerable difficulty.

1707. In complete closure of the entrance of the *vagina* by the *hymen*, the person must be laid on her back with the thighs drawn up and separated ; the *labia* are to be held aside by assistants, and a lancet passed into the middle of the stretched membrane, without injuring the *rectum* or bladder. The aperture is to be enlarged with curved scissors, or with a narrow curved bistoury, introduced upon a director. When the *hymen* is firm and tough, some practitioners advise the removal of the flaps thus formed. If the operation be performed on a child, or in a case where there is not any collection of blood, especial caution is requisite to avoid injuring the bladder or *rectum*. The membrane must then be divided with cautious cuts, and previous introduction of a sound or catheter into the *urethra*, to prevent it being injured. When the *urethra* is also covered with this membrane, the operation must be performed with the greatest care. If the *labia* be completely united, they must be stretched as much as possible to either side, and divided in the middle with careful strokes of the knife, till a director can be introduced, and upon it a bntton-ended bistoury must complete the necessary enlargement. The same proceeding must be adopted if the entrance of the *vagina* be closed by a fleshy mass (*a*).

1708. If the mouth of the *vagina* be only partially closed by the *hymen*, or if the *labia* be united, a director must be introduced through the aperture, usually existing at the upper part near the *urethra*, upon which a narrow button-ended bistoury is passed, and the connexion divided to the necessary extent.

[In infants it is better not to use a knife, but merely to pass a probe through the aperture above down to the bottom of the *os externum*, and then pressing the connecting skin with the probe point upon the finger-nail, till it make its way through, which is generally done with ease ; one end of the probe must be held steady whilst the other is drawn forwards, and tears its way out. A piece of lint inserted between the parts is all that is needful. And I do not recollect a case among several on which I have operated, that required any further interference.—J. F. S.]

(*a*) DONAULD ; in Journal de Médecine, vol xxxvii.

1709. If the closure be more or less deep in the canal of the *vagina*, its condition and extent must first be carefully ascertained by examination by the *vagina* and *rectum*. After emptying the bladder and *rectum*, the oiled finger of the left hand is to be carried up to the closed part, placed upon its middle, and a narrow scalpel, guarded with plaster to within an inch of its tip, or a pharyngotome, or Osiander's hysterotome (*a*) is to be introduced and thrust in the direction of the *vagina*, through the closed part. The aperture is to be enlarged, rather by pressure than by sawing with the knife, according to the situation, where it can be done without danger of wounding the bladder or the *rectum*. The point of the left finger is then to be introduced into the opening, which is to be enlarged with a button-ended bistoury, to the extent and in the direction where it can be done most safely, and seems most necessary.

In complete closure of the *vagina*, without any symptoms of retained menstrual fluid, the operation is contra-indicated, as the womb may be wanting, and the blind extremity of the *vagina* may touch the *peritonæum*. Columbus (*b*), Bousquet (*c*), Meyer (*d*), and Kleinkosck (*e*), have given cases of this kind. Stein (*f*) and Busch (*g*) operated on such cases, and opened the *peritonæum*, in consequence of which the woman died. In a case of Oberteuffer's (*h*), the woman did not indeed die, but the operation was useless. In all these cases the women had not menstruated.

1710. When the canal of the *vagina* is only partially closed, a button-ended bistoury is to be introduced by means of the left fore-finger, or a director, and the connexions divided to the proper extent, without wounding the bladder or *rectum*. Membranous bands are best divided with blunt-ended scissors, which are introduced upon the left forefinger. If closure of the *vagina* accompany pregnancy, the operation must be first performed, when, the pains coming on the membranes present, which can be easily felt through the *vagina* or through the *rectum* (*i*).

[My friend Dr. Locock informs me that he attended a lady who, in consequence of previous difficult labour with tearing of the *perinæum* and *vagina* into the *rectum*, had as she recovered numerous bands formed across the *vagina*. She became again pregnant, and great fear was entertained as to the result of the delivery. He allowed the labour to go on as usual, and as the child's head descended, and the bands became stretched, he divided them carefully with a bistoury, and the case did well. A second pregnancy and delivery followed under similar circumstances. If no operation be performed, and the child's head cannot descend, the womb will burst, and as in the case related by Kennedy (*k*), a triangular flap of the mouth and neck of that organ be thrown down into the *vagina*. In another case, which occurred to Labat, one band had been divided, and whilst waiting for pains to force the other, the whole recto-vaginal *septum* gave way, and the *rectum* and *vagina* became one cavity, leaving, however, the *sphincter ani* unhurt.—J. F. S.]

1711. If the *vagina* be only narrowed, it may be attempted to enlarge it gradually with bougies, sponge tent, relaxing injections, and the like. If pregnancy occur during such narrowing, the *vagina* often yields during that period, and during labour, to such extent, that although previously it had not the width of a quill, yet the expulsion of the child is effected (*l*). In cases where this yielding does not follow, some sufficiently deep cuts

(*a*) Neue Denkwürdigkeiten für Aerzte und Geburtshelfer, vol. i. p. ii. f. 4. Götting. 1727.

(*b*) De re anatomicâ, book xv. p. 495.

(*c*) Journal de Médecine, vol. vi. p. 128. 1775.

(*d*) Schmucker's vermischte chirurg. Schrift., vol. ii. p. 299.

(*e*) Dissert. de Utero deficiente. Prag. 1777.

(*f*) Hufeland's Journal. May, 1819.

(*g*) Rust's Magazin, vol. x. part 2.

(*h*) Stark's neues Archiv. vol. ii. p. 227.

(*i*) Naegle, Erfahrungen und Abhandlungen aus dem Gebiete der Krankheiten des Weiblichen Geschlects. Mannheim, 1812, p. 334.—von Seibold, E., Handbuch zur Erkenntniss und Heilung der Frauenzimmerkrankheiten. Frankf., 1821. Second Edition, vol. i. p. 216.

(*k*) Johnson's Med.-Chir. Jour., vol. xxxi. p. 570, 1839.

(*l*) Antoine; in Hist. de l'Académie des Sciences, 1712, p. 48.—Obs. Anat. 2.—Toison, ibid., 1748, p. 83.—Obs. Anat. 1.

must be made in the narrowed parts (*a*); and, if possible, they should be made on the sides, as if they be directed from before backwards, there is danger on account of the growing together of the *vagina* with the bladder and the *rectum*, of wounding them. If the *vagina* be extremely narrow, opening the head by a cut through the *perinæum* may be required (*b*).

1712. If the menstrual blood be collected behind the closed *vagina*, it escapes after the opening is made, and is black and free from smell. It must be completely emptied by injection, otherwise it will putrify on the admission of the air, and unpleasant symptoms will be produced. At first the most proper injections are those of luke-warm water, of decoction of mallows or marshmallows; but so soon as there is the least smell tincture of myrrh should be added, or injections of bark, with the addition of acid, spirits of camphor, solution of chloride of lime, and the like. If there be active inflammation, smart antiphlogistic treatment must be employed. In order to prevent reunion, it is sufficient, after dividing the *labia*, to keep them separate with a piece of oiled linen. After division at the entrance of the *vagina*, a sufficiently thick plug of lint must be introduced. Where the narrowing was high up in the *vagina*, and tough, its reunion is much to be feared; in such cases it will be necessary to oppose this disposition by the continued introduction of thick plugs of lint, sponge tent, elastic cylinders, and the like. The use of dilators often very considerably assists these means. If it happen that, under these circumstances, symptoms of violent irritation ensue, a corresponding cooling and soothing treatment must be had recourse to.

XII.—OF CLOSURE AND NARROWING OF THE MOUTH OF THE WOMB.

1713. The closure of the mouth of the womb is either a vice of the first formation, or first occurs at a later period, and may depend on a membrane closing the aperture, or on its growing together. The symptoms thereby produced depend on the retention of the menstrual blood, or, if the closure first occur during pregnancy, on the obstruction of the labour.

1714. In the *former* case, closure of the mouth of the womb may be presumed, if, on the appearance of the symptoms accompanying menstruation, no blood flows; if this, again, happen regularly, the womb gradually enlarges, and the belly swells. On examination, the *vagina* is found perfectly free, the distended mouth of the womb descends into the *pelvis*, and may be pushed upwards and backwards by introducing the fingers into the *vagina*. If the mouth of the womb be closed by membrane, it is often found filled out like a sac. The closure of the outer mouth of the womb may be distinguished by the finger, and that of the inner by the careful introduction of a sound.

1715. If the blood collected in the womb cannot escape, it may, as it continues increasing, make its way through the Fallopian tubes into the belly, and cause fatal symptoms. But if the mouth of the womb be closed by membrane, the membrane may be torn by the pressure of the blood which will escape. The only remedy consists in opening the closed part.

1716. When the outer mouth of the womb is closed, the forefinger of the left hand, with its palm or surface upwards, must be introduced up to the part to be opened, upon it a curved trocar, pharyngotome, or OSIANDER's hysterotome is to be passed, and the membrane closing the mouth of the

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(*a*) PETIT, J. L., Traité des Maladies chirurgicales, vol. vi. p. 110.

(*b*) CHAMPENOIS; in Journal de Médecine, vol. xli.

womb pierced. But if the canal of the neck of the womb, or its inner mouth, be closed, then must the pharyngotome or hysterotome, introduced in the way described, be carefully thrust through the part to be opened, and when the cavity of the womb is penetrated the opening must be enlarged sufficiently with the bistoury.

1717. The discharge of the menstrual fluid must be favoured by injections, as was done in opening the *vagina*, and its reunion prevented by a sufficiently long plug of lint inserted into the new opening, or by the introduction of an elastic tube. The after-treatment must be guided according to appearance of inflammatory and spasmodic symptoms.

The inflammatory symptoms after this operation are so severe that DUPUYTREN decides upon entirely giving it up, and rather to allow the patient to die more quietly and slowly than to speedily hasten her death by the operation, which always results from inflammation of the womb, and which is the more violent in proportion to the distension of the womb. (PIGNÉ.) Successful cases following this operation have, however, refuted DUPUYTREN's assertion. DU CUMIN (*a*) employed DUPUYTREN's double lithotome in a case of secondary union of the mouth of the womb, and the result was permanent. The greatest care must be exerted for the complete discharge of all the decomposed blood.

1718. When the mouth of the womb has grown together during pregnancy, or is so changed by hardening and scirrhous degeneration, that it will not dilate during labour, perhaps the whole lower part of the womb may descend so low, that there may be dread of it tearing, then the opening or enlargement of the mouth of the womb must be resolved on (*Hysterotomia vaginalis*, Lat.; *Scheiden-Kaiserschnitt*, Germ.)

1719. In scirrhous degeneration, or hardening of the mouth of the womb, a button-ended concave bistoury must be introduced into it upon the forefinger of the left hand, a cut made into it, and continued from two and a half to three inches into the substance of the womb. The direction of the cut should be to the left, or right, or forwards, or backwards, or in any other way, for the purpose of giving the wound proper size, according to the position of the womb, and, as far as possible, to cut into the part least changed. A cut has also been made in stricture of the mouth of the womb, during labour, throughout its whole length (*b*). The labour proceeds naturally, or may require to be finished by manual and instrumental assistance.

1720. If the mouth of the womb be completely closed, or cannot be felt, a blunt-ended scalpel is to be introduced on the forefinger of the left hand, and division of the protruded mouth of the womb made carefully from before backwards, or from one to the other side. When its cavity is reached, the cut must be made with the button-ended bistoury in the direction laid down, and if the cut cannot be made of sufficient size a second must be made to cross the former. The further treatment is the same as in the former cases.

See also upon this subject—

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(*a*) Gaz. Méd. de Paris, vol. viii. p. 91. 1840.

(*b*) MOSCATI; in OMODEI, Annali Universali, vol. xi. p. 257. 1819.—WAGNER; in Med. Jahrbüchern des österl. Staates, vol. xxii. p. 367.

FOURTH DIVISION.

DISEASES DEPENDING ON THE PRESENCE OF FOREIGN BODIES.

1721. Under the term *foreign* bodies are included not merely *mechanical* bodies conveyed *from without* into our organism, but also those *products which, generated and retained in our organism*, react upon it injuriously.

1722. They may, therefore, be treated of according to the following division :—

I. Foreign Bodies brought into our organism from without,
  1. Into the nostrils.
  2. ——— mouth.
  3. ——— *œsophagus* and intestinal canal.
  4. ——— air tube.

II. Unnatural collections of natural products.
  A. In their natural cavities and receptacles (retentions.)
    1. Ranula.
    2. Retention of urine.
    3. ——— the *fœtus* in the womb or in the belly (Cæsarean operation, division of the *pubes*, Gastrotomy.)
  B. External to their proper cavities and receptacles (extravasations.)
    1. Blood-swellings in newly-born children.
    2. Hæmatocele.
    3. Extravasation of blood in joints.

III. Collections of diseased products.
  1. Lymph swellings.
  2. Dropsy of the mucous bags.
  3. ——— joints.
  4. ——— the chest and *empyema.*
  5. ——— the head and *spina bifida.*
  6. Collections of pus in the breast-bone.
  7. Dropsy of the *pericardium.*
  8. ——— belly.
  9. ——— ovaries.
  10. Hydrocele.

IV. Formations of stony concretions.

Here are reviewed all those diseased conditions which have been already considered, on account of the close relation in which they stand to others; for instance, foreign bodies penetrating from without, and the extravasations in the various cavities, the retention of the bile, of the spittle in the Stenonian duct, and the like.

FIRST SECTION.—OF FOREIGN BODIES INTRODUCED INTO THE BODY FROM WITHOUT.

1723. What relates to foreign bodies, which in various ways complicate wounds, has been already treated of, (*par.* 306 and 338,) both as regards their effect, and the necessity, and the kind and mode of their removal. Here only will be considered those which penetrate into the open cavities of our bodies.

I.—OF FOREIGN BODIES IN THE NOSTRILS.

1724. Foreign bodies which get into the nostrils, are retained, either by the swelling which they undergo, as beans, peas, and the like, which children frequently thrust into their nose; or, if they do not themselves enlarge, are enclosed by the swelling of the mucous membrane of the nostrils, which they set up.

1725. The removal of these foreign bodies is not very difficult if there be not much accompanying swelling; it is often, however, rendered easier by the softness which most of them acquire as they swell up. For their removal, curved, dressing or polypus forceps are used; and if they cannot be got out whole, we endeavour to break them to pieces.

When, in gun-shot wounds of the face, balls remain lodged in the nostrils, they in general so quickly produce violent swelling and inflammation that it is impossible to get them out. In many cases they may remain till discharged by suppuration. But if, by their presence, violent symptoms are produced, they must be removed; and if, on account of the peculiar form and size of the foreign body, the opening of the nostrils offer much obstacle, it may be necessary to slit up one or other of them, and after the removal of the foreign body, to reunite them by the application of a stitch.

The position and size of foreign bodies is often such that they cannot be seized with the forceps; in these cases **DUPUYTREN** (*a*) advises that they should be pushed backwards, so as to drop into the mouth, which is the way they generally take if left alone for a time to escape of their own accord.

[**ASTLEY COOPER** used to mention an instance of a ball having been received in the frontal sinuses, which for a time remained quiet, but at last its weight caused ulceration; it descended through the nostrils, and, passing through the floor of the nose into the mouth, caused severe bleeding from the palatine artery.—J. F. S.]

II.—OF FOREIGN BODIES IN THE MOUTH.

1726. Foreign bodies which remain sticking in the inside of the cheeks, in the tongue, or in the palate, may cause severe pain, difficulty in swallowing, and very considerable swelling of the tongue. They can be easily discovered by careful examination, and removed with the forceps. If allowed to remain, they are generally soon got rid of by suppuration.

[I have very recently operated on a case in which a piece of tobacco-pipe, an inch and a half long, had been lodged in the cheek for ten months, without the patient being aware of it. He had fallen with his pipe in hand, and wounded the outside of his cheek; much swelling ensued, and after a few weeks the wound healed, but he could not open his mouth completely nor without pain. Twice during the following twelvemonth the swelling, which still remained, became very painful, increased, and suppurated. The last time he came to me, and the piece of pipe was readily discovered, running from half an inch behind the angle of the mouth horizontally back towards the angle of the jaw, the mouth could not be opened more than half an inch, and each time the jaw was depressed he had great pain at the angle of the jaw. I cut upon the scar, which was very apparent, but had some little difficulty in detaching the end of the pipe, as the scar had probably sunk into its hollow; this done, however, it was easily drawn out with dressing forceps, like a dirk from its scabbard, and was evidently smeared with a mucoid secretion from the sides of the cavity, which it had made for itself. In a few

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(*a*) Blessures par Armes de guerres; publ. par. MAUX et PAILLARD, vol. ii. p. 232.

days the effects of the operation ceased: he opened his mouth freely, and without pain, and the sinus filled up.

Bodies may sometimes be thrust into the mouth, within the arches of the teeth, and when there become so fixed by the elevating muscles of the lower jaw, as to be incapable of removal without assistance; I knew of a case of this kind in which a girl thus fixed an apple in her mouth, which was only removed by the medical attendant cutting it to pieces.—J. F. S.]

III.—OF FOREIGN BODIES IN THE ŒSOPHAGUS.

Hevin, Précis d'Observations sur les corps étrangers arrêtés dans l'Œsophage, et dans la Trachée-artère, avec des remarques sur les moyens qu'on a employés ou que l'on peut employer pour les enfoncer ou pour les retirer; in Mém. de l'Acad. de Chirurg., vol. i. p. 444.

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Vacca Berlinghieri, Della Esofagotomia e di un nuovo methodo di eseguirla. Pisa, 1820; with a plate.

1727. Bodies may remain sticking in the *œsophagus* on account of their size or hardness, or their irregular pointed surface. Bodies are often retained in the *œsophagus*, which, as regards their size and character, might without difficulty have passed through it, in which case it would seem that their fixture must be ascribed rather to a spasmodic contraction of that tube. The stoppage is commonly at the upper or lower part, and rarely in the middle of the *œsophagus*.

[I recollect several years since examining the body of a man who was brought to the hospital, and supposed to have died of apoplexy. On accidentally removing the tongue, *pharynx*, and neighbouring parts, an enormous lump of beef was found completely filling up the whole *pharynx*, and compressing the *epiglottis*. Inquiring about the circumstances of his death, it was ascertained that, whilst eating soup for his supper, he suddenly rose from the table, went out of doors, and shortly after was found dead near the threshold. The preparation is in the Museum at St. Thomas's.

I have known an instance occurring twice in the same person, who, had he not been a medical man, would probably have been suffocated before assistance could have been obtained. In eating his breakfast quickly, he suddenly felt choked, could not swallow the morsel in his throat, and could not breathe; he thrust his fingers back to try and pull out the morsel, in which he succeeded, and found the small portion of meat swallowed was attached by a thread of cellular tissue to another portion, which had become entangled in his teeth, and the thread had pressed down the *epiglottis*, so that every effort to swallow made him still worse. The same accident occurred to him a second time, but was in the same way relieved.—J. F. S.]

1728. The symptoms produced under this condition are, local pain, spasmodic contraction of the *œsophagus*, disposition to vomit, choking, or less difficulty in swallowing, symptoms of suffocation, and frequently actual suffocation, which depend partly on compression of the windpipe, partly on the spasmodic contraction of the *glottis*. Sometimes, and, if the body be small and painful, there is merely a local painful sensation. The inflammation may also be so violent, that it may run on to gangrene, though this in general only occurs when forcible efforts are made for the removal of the foreign body.

1729. It is often very difficult to decide upon the presence of a foreign body in the *œsophagus*. When a body more or less bulky, or with an irregular surface, is swallowed, if the patient feel pain at a particular spot, if swallowing be difficult and painful, and the respiration interfered with, yet these symptoms may be merely the consequence of the descent of the foreign body, of wound of the wall of the *œsophagus* at a particular spot, and of the inflammation resulting therefrom. If a bulky body remain sticking in the upper part of the *œsophagus*, it may often be felt externally; or, if the tongue be strongly depressed, its presence may be ascertained either by seeing it, by feeling it with the finger, or with a whalebone or elastic sound, or with DUPUYTREN's (*a*) œsophageal sound of elastic silver, with a little spherical ball at its extremity. These examinations must be always made with exceeding carefulness, and especially may be only made when active inflammation has not yet set in.

[It not unfrequently happens that, after a person has had a fish-bone stick in his *œsophagus*, though he can take food, yet a soreness remains, which is generally supposed to arise merely from the scratching of the lining membrane, and will subside in a few days, it being presumed that, as he swallows solid food, there cannot be anything lodging; and this more especially if an œsophageal bougie have been passed into the stomach. That this opinion may be too hastily formed, is proved by the following example. A friend of mine, whilst eating fish, suddenly felt that he had swallowed a fish-bone, and became so uncomfortable that he was obliged to leave the table, and within a couple of hours went to his medical attendant, who pulled out a piece of fish-bone with forceps. On the following day he still continued very uneasy, his throat being very sore, and felt assured that he had still a piece of bone in his throat; his medical friend, however, very naturally considered the sensation depended merely on the scratch of the bone he had removed. For four days the symptoms of obstruction continued, and he was much harassed, anxious, and became very ill. On the fifth day his son, a very able Surgeon, passed an œsophageal bougie without the least hindrance, and it was then thought quite impossible there could be anything in the passage, and that the symptoms merely depended on the previous irritation. On the evening of the very same day he suffered much pricking in his throat, was attacked with a violent cough, and threw out *another* bone, immediately after which he became easy, and all the symptoms quickly ceased. It is presumed that this second bone had lain obliquely across the *œsophagus*, and that, as the bougie descended, one end of it had been disengaged, as the instrument distended the canal, and, being thus more conveniently and loosely seated, the bone had been shot out by the cough. The remembrance of this interesting case will induce caution in giving a positive opinion of a foreign body not being present in the *œsophagus*, although swallowing may be effected, and even a bougie passed without obstruction. —J. F. S.

In the College Museum there is the whalebone handle of a punch-ladle, marked "It had been in the *œsophagus* sixty-eight hours without doing mischief;" but nothing more is known about it. It was in HEAVISIDE's collection.

MONRO indeed mentions the case of a boy who had attempted to swallow a halfpenny: it remained in his *œsophagus* "three years, and possibly it might have remained there for a much longer period had he not been seized with consumption, which proved fatal to him. Upon examination the gullet was found closely embracing the halfpenny, and considerably expanded by it. A halfpenny stuck in the gullet of another boy for six months, and was afterwards extracted by MONRO's father with a blunt hook." (p. 18.) He also mentions an instance in which an extraneous body, detained at the origin of the gullet, became lodged in a sac of some length, which descended behind the *œsophagus*. (*ib.*)]

1730. Foreign bodies in the *œsophagus* may either be drawn upwards, or thrust down into the stomach, or removed by a cut into the *œsophagus*.

1731. The *removal* of the body *upwards* may be effected by vomiting, produced either by irritating the throat, or by the exhibition of an emetic,

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(*a*) SABATIER, Médecine Opératoire, vol. iv. p. 52.

if swallowing be not entirely prevented, or by the injection of a solution of tartarized antimony into a vein (*a*). It must, however, be observed, in reference to the vomiting, that if the body firmly close the œsophageal tube, and will not be moved by the sickness, the mischief is increased, and even tearing of the *œsophagus* may ensue.

If the foreign body be at the upper part of the *œsophagus*, it may often, if the tongue be strongly depressed, be seized with the finger, or with a pair of œsophageal forceps, and withdrawn. If it be lower down, it may be removed also by the forceps, or a blunt hook, formed of a piece of wire bent together; or by a whalebone sound with a piece of sponge attached to its extremity, which is to be passed below the body, and when the sponge has swollen by the absorption of the moisture, may be withdrawn. Little pointed bodies, as needles, fish-bones, and pieces of bone, are generally more easily removed with the sponge. A flexible sound, having its extremity armed with several loops of metal, has been recommended for this purpose. Bulky bodies, which completely fill the *œsophagus*, are very difficult of removal, because the instrument cannot be passed beyond them. Attempts at removal must always be made with great care and consideration. DELPECH (*b*) objects to the use of the hooks and metallic loops as inefficient and dangerous.

The peculiar operation of the vomiting is not merely the commotion but the inverted contraction of the muscular fibres of the *œsophagus*. For the purpose of making the *œsophagus* slippery, mucilaginous and oily remedies, melted butter, oil with camomile tea, or yolk of egg and the like must be administered. Tobacco clysters are often advantageous in producing vomiting and diminishing the spasm. The removal of a fish-hook, which had been swallowed, the line of which remained hanging out of the mouth, by means of a perforated bullet through which the thread was passed, and the bullet allowed to drop down into the curve of the hook so as to shield its point, is mentioned by BRIGHT (*c*).

1732. In *thrusting down foreign bodies into the stomach*, a whalebone sound, with a piece of sponge at one end, commonly called a probang, first smeared with oil, is employed. This mode is to be practised especially if the foreign body be soft and have a smooth surface; but if it be rough or pointed, considerable injury to the *œsophagus* may be effected by thrusting it down, and it may be even of such character, that on account of its mere presence in the *œsophagus*, dangerous symptoms may be dreaded. Under these circumstances, only the most urgent symptoms, and the impossibility of getting rid of the body in any other way, will determine that it should be thrust down. The patient may be allowed to swallow mouthfuls of chewed bread, and the like, which often drive the body down, and a blow between the shoulders will often loosen it.

If a body capable of being broken up, as for instance, a potato remain sticking in the upper part of the *œsophagus* and cannot be thrust down into the stomach, attempts must be made to press it upwards, with the fingers upon the surface of the throat, as DUPUYTREN did very successfully, and quickly relieved the patient after all other efforts had been in vain. (PIGNÉ.)

[Before proceeding to thrust an extraneous body down the *œsophagus*, a careful examination should be made with the finger, to ascertain if it be within reach, and can be removed; the importance of doing this is proved by the following case, which ASTLEY COOPER was accustomed to relate (*d*). A child, whilst dining with his parents on his birthday, swallowed a fish-bone, and was attacked with violent cough; COOPER, not being in the way, another Surgeon was found, who passed a probang; the symptoms,

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(*a*) KÖHLER; in SCHMUCKER'S vermischten Schriften, vol. i. p. 335.—BALK; in MURSENNA'S Journal, vol. ii. p. 64.—KRAUSS; in HÜFELAND'S Journal, 1811, vol. vi. p. 116.—GRAEFE.

(*b*) Précis Elémentaire, vol. ii. p. 59.

(*c*) American Medical Recorder. 1823. July, p. 581.

(*d*) MS. Lectures.

however, became worse, were followed by convulsions, and, between ten and eleven o'clock of the same evening, the child died. Having obtained permission, Cooper opened the *larynx* with a lancet, and found a piece of fish-bone situated just at the *glottis*, which he readily hooked out with his finger-nail.

Dr. Brown (*a*) mentions the case of a woman who, in eating oatmeal porridge, swallowed a piece of a broken delf plate, which pierced the *œsophagus* on the right side, midway between the cricoid cartilage and the breast-bone. She soon made an effort to vomit, and a discharge of blood from the mouth ensued and repeated on the passage of a probang, which she thought displaced the bit of delf. On the day following she was seen by Brown, and had then inflammation and swelling of the external *fauces* in the line of the *œsophagus*, with total inability to swallow. The foreign body could not be felt externally; and a probang was twice passed with facility. Leeches and cold lotion were applied, and on the sixth day the inflammation had almost ceased, and she swallowed well. On the ninth day she was attacked with pain in the stomach, which lasted two days, and on the tenth she vomited a pint of dark fœtid blood, which continued in smaller quantities. On the twelfth day she spat up more than a pint of brown fœtid sputa, and died at midnight. No examination was permitted. Brown considers that the bit of plate was at first thrust down into the stomach, and that the inflammation of the *œsophagus* depended on the violence with which this was done. He imagines that the fatal symptoms resulted from the hard substance wounding the stomach, especially as that organ was comparatively empty from the accident to her death. And that the pain in the left *hypochondrium* pointed out injury to the left extremity of the stomach, near the *cardia*, where some large branch of the coronary, or left gastro-epiploic artery must have been divided, as the quantity of blood poured out was so large as to colour the fæcal discharges.

[My friend and pupil Tunaley, of Camden Town, has given me the following case, which shows the propriety of Astley Cooper's advice, and which, but for the prompt and judicious treatment, would also probably have terminated fatally, although the foreign body was merely a piece of bristle from a brush, about an inch in length. A lady, whilst eating bread and butter, felt something in her mouth which seemed like a piece of wood, and not choosing to spit it out, as she was in a party, determined to swallow it with the morsel in her mouth. In doing this, the sharp substance lodged in her throat, produced a constant pricking, and in the course of a few hours cough and repeated attempts at deglutition. She was seen shortly after by a medical man, who examined the throat, and, finding nothing, considered it merely a case of local irritation, and treated it accordingly. Next day she was worse, and an emetic was given, which quickly aggravated the symptoms to such an extent, as to threaten immediate suffocation. Twenty-four hours after the accident, Tunaley saw her, and it was then necessary at once to perform tracheotomy, which he did immediately below the cricoid cartilage; and, scooping out its under edge, he introduced an elastic catheter, which relieved her directly. Four hours after, when the spasm had subsided, he made an examination with his finger, by the mouth, and could just feel, when an attempt to swallow was made, the point of what he took for a pin; but it was not under command of the finger. He then passed a pair of dressing forceps, bent for the purpose, into the throat, and, after persevering efforts, as the patient's exhaustion would admit, during two hours, at last succeeded in pulling out a bristle, which, he considers, had penetrated the mucous membrane at the root of the *epiglottis*, and, by its continued irritation, had produced the spasm of the *glottis*. The patient speedily recovered.—J. F. S.]

1733. When the body has caused severe inflammation and diseased contraction of the *œsophagus*, all attempts at its removal must be given up, and the treatment confined simply to blood-letting, leeching, oily injections, and if there be accompanying spasm, opium. When by these means the inflammation, swelling and contraction of the *œsophagus* have diminished, it not unfrequently happens that the body gets loose, and can be removed one way or another.

1734. Whether the body be drawn up or thrust down, frequently local inconveniences remain in the *œsophagus*, as wounds, inflammation, and suppuration, which require corresponding antiphlogistic and soothing treatment. Narrowing of the *œsophagus* may result at a subsequent period, and if the body be bulky, suppuration even may ensue.

(*a*) Edinburgh Med. and Surg. Journal, vol. xxxvi. p. 56. 1831.

1735. Thin and pointed bodies, needles for example, may penetrate the walls of the *œsophagus* and gradually make their way through the neighbouring parts, so that they often reappear at very distant parts. This more frequently occurs when the bodies have passed into the stomach, and then travel through the different organs, sometimes accompanied with no pain, but at other times with great pain.

1736. When the foreign body can neither be pulled up nor thrust down into the stomach, if it produce urgent symptoms, and be not very low in the *œsophagus*, or if it be of such kind that its descent into the stomach would be productive of great danger, then it must be removed by cutting into the *œsophagus* (*Œsophogotomia.*) This operation is always one of the most difficult and dangerous, though under the circumstances it must be held to be the only means of relief, and by observing certain rules, is much facilitated. The parts of which injury is to be feared are the carotid artery, the internal jugular vein, the recurrent nerve, and the thyroideal arteries.

CALLISEN (*a*), as well as BENJAMIN BELL and RICHERAND, only allow œsophagotomy when the foreign body can be felt externally, and in the contrary case will have an opening made in the windpipe to prevent the danger of suffocation. According to ZANG (*b*), however, the operation may be undertaken, if nothing be felt externally, if only the place be known where the body is situated. In these cases also the mode of operation laid down by VACCA BERLINGHIERI may be safely performed.

[As the more serious symptoms which occur when a foreign body sticks in the *pharynx* or *œsophagus*, depend on the pressure it makes upon that part of the air-tube to which it is opposite, I think it would be advisable to perform tracheotomy in preference to the difficult and dangerous operation of cutting into the *œsophagus*. This mode of treatment has been successful, as in the case of the boy who attempted to swallow nine pistoles wrapped in a piece of cloth, mentioned by HABICOT (*c*). The packet stuck in the narrow part of the *pharynx*, and he was almost suffocated. Attempts to thrust it down were made; but in vain. HABICOT, therefore, to relieve the most urgent symptoms, cut into the windpipe; the difficulty of breathing, the swelling and blueness of the face ceased immediately; and the money then thrust down with a leaden sound into the stomach, was passed by stool a few days after.]

1737. According to VERDUC-GUATTANI, the operation is to be performed in the following manner. The patient having been placed in an arm-chair, or laid upon a table, and his head properly held by an assistant, a cut from two and a half to three inches in length must be made vertically through the skin and cellular tissue, upon the left side of the air-tube between the *larynx* and the collar-bone. Then, the assistant having drawn the edges of the wound asunder with blunt hooks, and the blood being absorbed with a moist sponge, it must be endeavoured to dig under the edge of the thyroid gland with the handle of the scalpel, and keeping still on the one side of the air-tube, and using the blade of the knife as little as possible, the *œsophagus* is to be laid bare, and so cut into that the foreign body may be removed with a pair of straight forceps, without tearing the edges of the wound. If the foreign body be a little distant from the opening, a pair of curved forceps must be used for its removal. Any spirting vessels must be immediately taken up during the operation, as well also the thyroideal arteries, if they come in the way, before cutting them through.

ECKOLDT's method, in which a cut is made through the skin, close to the middle of the *m. sterno-mastoideus*, and the division of the cellular tissue in the triangular space formed by the division of this muscle before its insertion into the breast- and collar-bone, and the *œsophagus* laid bare and cut into, is manifestly less safe than that just described.

(*a*) Systema Chirurgiæ, vol. ii. p. 421. (*b*) Operationen, vol. iii. p. 40.
(*c*) Mém. de l'Acad. de Chir., vol. xii. p. 243. Edit. in 12mo.

1738. In those cases in which the foreign body forms no perceptible swelling externally, and for the purpose of especially projecting the wall of the *œsophagus*, it has been recommended to introduce a silver catheter, or a forked curved sound, through the mouth into the *œsophagus*, and to raise its left wall into the wound. The arrow-sound has also been advised for this purpose. RICHERAND (*a*) objects to the introduction of any instrument into the *œsophagus*, as a guide. VACCA BERLINGHIERI (*b*) has, however, proposed an instrument by which œsophagotomy is more easy and effectual than by any other mode.

1739. The patient is placed on a low stool; the head held firmly against the chest of one assistant, and the rest of the body by another. The skin-cut is to be made on the left side of the neck, in the direction of the thyroid and cricoid cartilage, on a fold of skin from the upper edge of the thyroid cartilage to two inches below it; if the *m. platysma myoides* be not then cut through, it must be divided with a second stroke of the knife into the underlying cellular tissue. The *ectropœsophag*, with the spring thrust fully forwards and thus completely closed, is to be introduced so deeply into the *œsophagus*, and so directed that its lower end corresponds to the lower angle of the wound. The fore and middle fingers are now to be introduced into the side rings of the canula, and the thumb into that of the shaft, which being drawn back, its spring end is set free, and with its olive-shaped knob, the wall of the *œsophagus* is thrust into the wound. The instrument is now held steadily by an assistant, the cellular tissue carefully cut into, and the *œsophagus* laid bare by drawing the *m. sterno-mastoideus* backwards, the *m. sterno-hyoideus* and *sterno-thyroideus* forwards, (with the assistance of the finger or a blunt hook,) and then the *m. omo-hyoideus*, which crosses the wound obliquely, is divided on a director. The *œsophagus* now appears to more than the extent of an inch, and must be cut into on the side, and a little forwards, between the canula and the diverging arms of the shaft, for two lines above the olive-shaped knob of the latter, and the cut enlarged upwards as far as may seem necessary. A blunt hook is then introduced into the *œsophagus*, to keep it steady. The ectropœsophag is now taken out, and the foreign body removed with the finger or forceps.

The ectropœsophag may be so easily arranged, that it may be used even if the operation be performed on the right side.

1740. According to BEGIN (*c*), it is impossible to operate upon the *œsophagus* in the region prescribed by VERDUC-GUATTANI's plan, or properly to introduce the instruments recommended for introduction by others, and to retain them in suitable position, as the irritated parts cannot bear constant touching, and the breathing has already become difficult. His method, which is founded on the most careful consideration of the anatomy of the parts concerned, and which has been several times performed on living persons, is the following:—The patient is laid upon a narrow bed, his shoulders and chest slightly raised, the head a little bent back, and supported with a pillow, and the neck moderately stretched. The operator standing on the left side, makes a cut through the skin, along the groove between the sterno-mastoid muscle and the windpipe, which he begins a finger's breadth above the sterno-clavicular articulation, and

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(*a*) Nosographie Chirurgicale, vol. iii. p. 260.

(*b*) Journal VON GRAEFE und VON WALTHER, vol. v. p. 712.—Chirurg. Kupfertaf., pl. cxxxv.

(*c*) Dict. de Méd. et de Chirurg. pratique, vol. xii. p. 152; and Nouv. Elém. de Chirurgie et de Méd. Opérat., vol. i. p. 260. Second Edition.

carries up as high as the upper edge of the thyroid cartilage. He now divides with long strokes the *m. platysma-myoides* and cellular tissue, and descends deeply into the cellular space between the windpipe and *œsophagus* within, and the deep vessels and nerves without, which are covered by the sterno-mastoid muscle, and the assistant, standing on the patient's right side, draws inwards the parts on the inside of the wound with his fingers or with a blunt hook, and the operator, with the fingers of his left hand thrust in more deeply draws outwards the parts on the outside of the wound, and with the point of his finger covers the vessels and nerves. The *m. omo-hyoideus* is then seen running obliquely outwards and downwards in the upper half of the wound, which, a director having been introduced beneath, must be divided. The *œsophagus* now appears, and is known by its position behind the windpipe and *larynx*, its round fleshy surface, its movements and hardness in the attempts to swallow. If the foreign body form a projection, it must be immediately cut upon; but under contrary circumstances, the knife is to be carried boldly in the middle of the wound parallel to the axis of the *œsophagus*, into it, and an opening made about half an inch long, from which immediately some mucus and spittle flow out, and in which, by the contraction of the circular fibres, the mucous membrane becomes visible. A button-ended bistoury is now introduced upon the forefinger, and the wound enlarged sufficiently upwards and downwards to admit the introduction of the forceps. It is better to enlarge the wound upwards rather than downwards, as wounding the superior is less dangerous than wounding the inferior thyroideal artery. Every bleeding vessel must be immediately taken up during the operation.

1741. No precise rules are laid down for the removal of the foreign body; it must depend on the delicacy of the touch, manual dexterity, and thought of the operator upon the moment, to determine how the difficulties may be best overcome. Curved and pretty strong polypus-forceps, with double curves, are in general most convenient, and a sufficient number of them, of various form and size, must be in readiness. (BEGIN.)

1742. After the removal of the foreign body, quick union should be aimed at according to the usual mode, with dressings; the edges of the wound are to be brought close together with sticking plaster, and the head kept inclined a little backwards and to the right side. For the first eight days the patient must be supported only with nourishing clysters and baths; and then with gelatinous substances in small quantities by the mouth; at first the patient's tormenting thirst must be quenched with Seville orange strewed with sugar, (*par.* 473,) and taken into the mouth. But, according to BEGIN, should the wound unite neither by sticking plaster, and still less by suture, as in the condition of the walls of the *œsophagus*, from the more or less severe inflammation and so on, agglutination, as in ordinary wounds, is not to be expected, but the edges should only be brought together, covered with perforated cloths spread with cerate, and wadding with compresses, fastened with a circular bandage. As the patient subjected to œsophagotomy becomes wasted by his incapability to swallow, want of rest and so on, some nourishing broth should be conveyed into his stomach by means of an œsophageal tube, the day after the operation.

IV.—OF FOREIGN BODIES IN THE STOMACH AND INTESTINAL CANAL.

HEVIN, above cited, p. 590.

1743. When bodies, insoluble by the powers of the digestive organs, are thrust down or swallowed into the stomach, they may produce different symptoms, depending principally on their form and nature. Bulky bodies often pass without any difficulty through the whole intestinal canal; pointed bodies are easily retained, and produce frequently inflammation and ulceration.

[Of the foreign substances received into the stomach, the most remarkable account is that given by Dr. MARCET (*a*), of the sailor who swallowed a number of clasp knives. In June, 1799, after having witnessed a display of jugglers' knife-swallowing, he, in a drunken fit, boasted he could do the same, and accordingly swallowed four pocket-knives successively. On the following afternoon he passed one knife by stool, and on the following day two more, but the fourth knife never came away, nor gave him inconvenience. In March, 1805, in the course of a couple of days, he swallowed fourteen knives more; but on the following morning was attacked with constant vomiting and pain at his stomach, which compelled him to go to the hospital, and in the course of a month, "he was safely delivered of his cargo." In December of the same year, he swallowed on one day five, and on the next fourteen more. He was very ill the next day, and obliged to put himself under medical care, but without benefit till three months after, when having taken castor oil, he felt the knives "dropping down the bowels," and became easier, but was not aware of having passed any. In June, 1806, he vomited a knife-handle; in November he passed some fragments, and again in February, 1807. In August of the same year he was admitted into Guy's Hospital, where at first his account was not believed, but he held fast to his story, and as he suffered intense pain at the region of the stomach, and a hardness was thought to be felt, some credence was at last given, and his stools being noticed were found of a deep black, indicating an accumulation of ferruginous matter in his bowels. On examining the *rectum*, a portion of the knife was felt lying across it, but could not be extracted on account of the great pain he suffered in the attempts to grasp it. Various attempts were made to dissolve the knives, but without success, and at last, in March, 1809, he died in a state of great emaciation. On *examination*, one of the blades and one of the back springs were found in the intestines, the latter, four inches and a half long, had transfixed the colon opposite the left kidney, and projected into the cavity of the abdomen, while the other was stretching across the *rectum*, with one of its extremities actually fixed in the muscular *parietes* of the *pelvis*. No stool had, however, escaped, nor were there any signs of active inflammation. In the stomach were thirty or forty fragments, of which thirteen or fourteen were evidently blades, much corroded and diminished in size. They are all in the Museum at Guy's Hospital.

Another instance is also related by Dr. BARNES, of Carlisle (*b*), of a juggler, who, on 17th November, 1823, accidentally swallowed a table-knife with a bone handle, together nine inches in length. The account given by the man was, that "having offered for a small sum of money to swallow a table-knife, a new one was accordingly brought from a neighbouring shop. The method by which I pretended to swallow it was, to pass the handle and part of the blade down my throat, and hold the point of the knife fast with my teeth. When I was on the point of drawing it out again, some person, coming unexpectedly behind me, gave me a smart stroke on the back, the surprise of which caused me to lose hold of the point, and immediately the whole knife slipped into the stomach. I directly made very violent efforts to throw it up, but in vain, and the endeavours of the Surgeon were equally useless." The man immediately became very much alarmed, expecting instant death. Attempts were made with the fingers and with long forceps to seize the knife, but it was far beyond their reach, and could not be felt on the external surface of the stomach. Next day he complained of pain in his stomach, for which he was bled, and a clyster given; and afterwards, having pain in the left shoulder shooting across the chest to the stomach, he was bled again. Soon after the handle of the knife could be felt very distinctly by pressing gently on the navel, though slight pressure gave him considerable pain; but a single cup of tea or a little food of any kind distended the stomach so much that it entirely disappeared.

(*a*) Med.-Chir. Trans., vol. xii. p. 52, 1822.

(*b*) JAMESON'S Edinburgh Philosoph. Journ., vol. xi. p. 319, 1824.—HADFIELD, A Statement of the Case of W. DEMPSTER, a juggler, who died in consequence of having swallowed a Table knife. Middlewich. A pamphlet.

Various suggestions were made, and among others gastrotomy, but the patient would not consent to it. He was able to walk about a little during the day, and could sleep at night on his back, but not on either side. He was frequently squeamish and sick at stomach, and sometimes felt a severe twisting pain in that organ. He kept quiet till 28th December, when he left on his way to London, but died at Middlewich on the 16th January following. From the account it is very evident that he never laboured under any urgent symptoms, and seems to have been worn out rather by terror and anxiety. "On opening the belly," Hadfield says, "my first attention being of course directed to the stomach, I found the knife beginning to protrude through a gangrenous opening about two inches and a half from the beginning of the *duodenum*, on which part the knife had lain. After opening the stomach, I found that the point of the knife rested on that part of the greater curvature, almost exactly opposite to the *cardia*, and had likewise very nearly perforated the coats. * * * The handle of the knife was completely dissolved, the rivets had disappeared, and a considerable portion (at least one-third) of the blade also. What was left appeared exceedingly rusty and black." This knife is in the Museum of the Royal College of Surgeons. In the same collection are some knives voided by a soldier in St. George's Hospital.]

1744. Bulky bodies are most commonly retained in the stomach and at the ileo-colic valve. They may remain in the stomach a considerable time without causing symptoms, which, however, they easily produce in the intestinal canal, even if they be not fixed. The symptoms especially depend on the stoppage of the alimentary canal, or on the inflammation and injury which the foreign body produces by its peculiar form. In the first case symptoms of *ileus* arise; in the second, more or less severe *enteritis*. Oxidizable metals for example: copper coins produce no peculiar symptoms, as their oxidation, whilst resting in the alimentary canal, is exceedingly slow and not to that extent, which produces dangerous effects (*a*); indeed, in general, they are not long enough retained.

[In the College Museum there is a very interesting preparation from a woman who had long suffered under symptoms of gall stones, and at last died exhausted. On examination, the gall-bladder was found thickened, contracted, and both it and the liver intimately adherent to the *duodenum* and adjacent organs. Between the gall-bladder and *duodenum* was a large ulcerated ragged opening of communication, through which a large gall stone had passed, and, getting into the *ileum*, had blocked it up. Above this part the gut was distended with air and biliary fluid. In the Museum at St. Thomas's there is a portion of small intestine from a child, which is in two or three parts completely filled with lumps of hardened stool, in appearance resembling *album Græcum*, the result of quantities of carbonate of magnesia, which becoming entangled with the mucus of the bowel, had formed complete plugs of an inch or more in length.

The College Museum also possesses an example of cherry-stones lodged in the *cæcum*, which had been swallowed by a boy twelve years of age, at least sixteen months before his death, during which time he continually suffered from symptoms of chronic *enteritis*.

Langstaff (*b*) gives an account of a madman who swallowed a silver table-spoon in October, 1827. Soon after his health gradually declined. Although he lived abstemiously his digestive organs were disordered; he suffered from dyspepsia, and frequently complained of an acute pain in the region of the *cæcum*; and he persisted in declaring that all these symptoms were occasioned by the spoon he had swallowed. His account was disbelieved, especially as cautious examination of the belly was made without detection of any foreign body. He continued to suffer from the effects of pain in the situation of the *cæcum* and *colon*, and frequently said he felt the motion of the spoon. He was teased with diarrhœa, and the evacuations were often mixed with blood and pus. Symptoms of diseased liver came on, and were followed by *ascites* and *œdema* of the lower limbs. Under these circumstances Langstaff tapped him, drew off a bucketful of water, and, as he was "greatly emaciated, I was induced," says Langstaff, "to carefully examine with my hand if I could feel the spoon, when, to my astonishment, I detected a solid substance in the situation of the *cæcum*, which induced me to believe

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(*a*) Claude René Drouard, Expériences et Observations sur l'Empoisonnement par l'Oxide de cuivre (*verd-de-gris*.) Paris, 1802.—Orfila, Traité de Poisons, vol. i. p. 243.

(*b*) Catalogue of the Preparations, &c., constituting the Anatomical Museum of George Langstaff. London, 1842. 8vo. p. 228–32.

that it was the spoon he had swallowed." He died about twenty months after, and on *examination* it was found that " the mucous coat of the stomach, as well as the *duodenum*, *jejunum*, *ileum*, and *cæcum* were more vascular than natural, and there were evident signs of their having been ulcerated on different portions, and that nature had put a perfect stop to the ulcerative process, by uniting the boundaries to the submucous tissue. The greatest degree of mischief had been effected by the passage of the spoon through the ileo-cæcal valve, which was greatly dilated and the circumference thickened. The mucous coat of the *cæcum* was nearly destroyed by ulceration. The spoon was found in this intestine, with the bowl downwards, where it had formed a large sac, which prevented its passage into the *colon*." The preparation is now in the Museum of the College of Surgeons.]

1745. Pointed bodies, when they remain hanging in the walls of the intestines, excite inflammation to such extent as to produce union of the surface with the *peritonæum* or any other part, so that when suppuration takes place by the continued operation of a foreign body, it may make its way in different directions, and proceed either to the surface of the body, or even into any other cavity, as, for instance, into the bladder.

[In rare instances a foreign body will make its way through the walls of the intestine and belly, as in the case of the boy ten years old, from whom plum and cherry stones were discharged by an abscess communicating with the gut, and which are in the College collection.]

1746. In order to protect the stomach and intestinal canal against the effects of any such body, mucilaginous ensheathing food, and especially antiphlogistic treatment and purgatives, to hasten the passage of the foreign body through the alimentary canal, must be employed.

[This is the ordinary practice usually employed; but I am not sure that the late Sir Francis Chantrey's proceeding under similar circumstances is not preferable. He had accidentally swallowed the gold fastening of one of his teeth, and, being much alarmed, came to my friend Green, to consult with him about the matter, at the same time suggesting the propriety of eating freely of suet pudding, with the hope of entangling the little gold plate, and favouring its passage through the bowels. Green saw no particular objection to this proposition, and accordingly a due quantity of the medicinal pudding was swallowed. Nothing more was heard or seen of the tooth-plate, and whether passed or not is unknown, but it never gave any inconvenience.—J. F. S.]

1747. If there be a foreign body in the stomach, or in the alimentary canal, which will not pass off by the usual ways, and if it cause great danger to life, it must be removed by *cutting into the stomach* (*Gastrotomia*) or *into the intestine* (*Enterotomia*.) To decide on this very dangerous operation is always extremely difficult; it should only be undertaken when most positively called for by the situation of the foreign body, and on this point the symptoms are very doubtful. The intestine in which the foreign body is may be far from the wall of the belly. As long as no very severe symptoms occur, the operation should not be rashly decided on; and if they have already set in, the result of the operation is the more doubtful. Gastrotomy has, however, been performed successfully (*a*).

Delpech (*b*) considers that there never can be such certainty of the situation of a foreign body in the stomach and intestinal canal as to decide on gastrotomy or enterotomy. If there be a swelling, with fixed pain, the treatment should be confined only to a superficial cut, when the skin is distinctly pressed up by the suppuration, because there is no certainty to what extent union is effected, and whether extravasation of fæcal matter can be prevented.

There is a remarkable case in which a fork having been swallowed, excited suppuration, and by enlarging the opening of the abscess, was removed (*c*).

For the removal of poison from the stomach, Read's, or Weiss's, or Graham's stomach-pumps may be employed.

(*a*) Baldinger's Neues Magazin für Aerzte, vol. xiii. p. 567.—Rust's Magazin, vol. viii. pt. i.

(*b*) Précis Elémentaire, vol. ii. pp. 67, 68.

(*c*) Salzburg, Med.-Chir. Zeitung, July 1836, p. 14.

[**Barnes** (*a*) quotes from **Becker** the case of a young peasant, who on 29th May, 1635, whilst endeavouring to produce vomiting with the handle of a knife, let it slip from his fingers, and pass into his stomach. He was much frightened, but able to go about his usual occupation. It was, however, determined to remove the knife by operation, which was done on the 9th of July following, by a Surgeon and Lithotomist, named **Shoval**. "A straight incision was made in the left *hypochondrion*, two fingers'-breadth under the false ribs; first through the skin and cellular membrane, then through the muscles and *peritonæum*. The stomach subsided, and slipped from the fingers, which prevented it from being immediately seized; but it was at length caught hold of with a curved needle, and drawn out of the wound. A small incision was then made into it upon the knife, which was then easily extracted. The stomach immediately collapsed. After the external wound had been properly cleansed, it was united with five sutures, and tepid balsam poured into the interstices. Tents impregnated with the same balsam, and a cataplasm of bolar earth, the white of egg, and alum, were then applied." (p. 324.) Two sutures were removed next day, on the following day two more, but the fifth is not noticed. On the fourteenth day after the operation, the wound had healed. Dr. **Oliver** (*b*) saw this knife at Königsberg in 1685, and says it was six and a half inches long. The patient completely recovered.]

1748. If the stomach contain nothing but the foreign body, it must be moderately filled before proceeding to the operation, with mucilaginous fluid, for the purpose of bringing it near the wall of the belly (*c*). If by feeling, the position of the foreign body can be distinguished, the cut should be made upon that part: but under other circumstances, upon the front wall of the stomach, an inch below the sword-like process of the breast-bone, to an inch and a half above the navel, about three quarters of an inch to the left of the white line, that the cut may be between the great and little curvature of the stomach. The wall of the belly is to be cut through with some careful strokes of the knife; and then the stomach being laid bare, search is made for the foreign body, and a knife thrust into the stomach at the proper place, and the wound enlarged with a button-ended bistoury. The foreign body is then to be sought for with a pair of forceps introduced upon the forefinger of the left hand, taken hold of, and drawn out. The further treatment must be according to the rules already laid down for wounds of the stomach (*par.* 541.)

Hevin also proposes piercing the front wall of the exposed stomach with a grooved trocar, and to enlarge the wound upon it right or left.

1749. In enterotomy, the wall of the belly should be cut into where the foreign body is distinguishable, though, if possible, on that part where the epigastric arteries can be avoided, search made with the finger for the position of the foreign body, the intestine containing it drawn into the wound, and then sufficiently cut into for the removal of the foreign body. The further treatment is the same as in wounds of the intestine (*par* 529 and the following.)

Cutting into the intestine has been proposed for stricture and closure of the large intestines, for unrelievable collection of stools, for *ileus* and *volvulus*, in which cases, an artificial *anus* may be at the same time formed (*par.* 1616.) Although in such cases the operation may be successfully performed (*d*), yet on account of the uncertainty of the cause, and of the actual seat of the disease, as well as on account of the symptoms, to a great extent, an unsatisfactory issue to the operation, is so probable (*e*), that practitioners are rarely inclined to it.

(*a*) Above cited.

(*b*) Phil. Trans., vol. xxii. p. 1408. 1700–01.

(*c*) **Hevin**, in Mém. de l'Acad. de Chirurg., vol. i. p. 598.

(*d*) **Velse**, C. P., Dissert. de mutuo Intestinorum ingressu. Lugd. Batav., 1742. — **Odier**, Manuel de Médecine pratique. Genève, an xi.

(*e*) **Hoegg**, A., Observationes medico-chirurgicæ. Jenæ, 1762. Observ. iii.; in **Sandifort**, Thesaurus Dissertationum, vol. iii. See also, **Leclerc**, D., Histoire de la Médecine, p. i. l. iv. ch. vi.—**Hevin**, Recherches Historiques sur la Gastrotomie, ou l'ouverture du bas-ventre dans les cas du volvulus ou de l'intussusception d'un intestin; in Mém. de l'Acad. de Chirurg., vol. iv.—**Hebenstreit's** Zusätze zu **Bell's** W. A. K., vol. ii. p. 3[illegible].—**Fuchsius**; in Hufeland's Journal, 1825, Feb., p. 42.

V.—OF FOREIGN BODIES IN THE RECTUM.

Morand, Collection de plusieurs Observations singulières sur des corps étrangers, les uns appliqués aux parties naturelles, d'autres insinués dans la vessie, et d'autres dans le fondement; in Mém. de l'Acad. de Chirurg., vol. iii. p. 606.

von Walther, Beobachtung eines fremden Körpers von ungewöhnlicher Grösse im Mastdarme; in Journal für Chirurgie und Augenheilkunde, vol. i. p. 435.

1750. Foreign bodies may be introduced through the *anus* into the *rectum*, either voluntarily or accidentally, in making a careful examination for certain things; or bodies which have been swallowed, after having passed through the bowels, may remain a longer or shorter time in the *rectum*; the passage of the swallowed body, however, in general causes no difficulty, as it is involved in a thick mass of stool. If the foreign body in the *rectum* excite symptoms, they depend on its peculiar form or its great size.

[(1) Phillips (*a*) mentions the case of an old man brought into St. Mary-le-bone Infirmary, who was delirious, and complained of having a stick in his *rectum*, and being unable to sit up without pain; but as no other information could be obtained about it, and no stick could be detected on examining the bowel, it was believed he was labouring under some delusion. A clyster was however given, but no stick was passed. On the third day he died, and on *examination*, at six inches above the *anus*, was found the inferior extremity of a stick, which was about as thick as an ordinary indicator finger; it was covered with its bark, and carefully rounded at each end. Its superior extremity had passed through the sigmoid flexure of the *colon* into the peritoneal cavity to the extent of four inches. The *peritonæum* was highly inflamed through its whole extent, but there was very little thickening about the tissues in the immediate vicinity of the perforated point. There was no appearance of disease in the *rectum*."

McLaughlan (*b*) relates the history of a Greenwich pensioner, aged forty-nine, who having introduced an immense plug of wood fitted to the *anus*, for the purpose of stopping a *diarrhœa*, fell accidentally upon a stool, and forced it up into the gut. Eight days after he applied for assistance, having in the mean while suffered severely from continual efforts to void his stools and urine, which last was done with great difficulty. The whole belly was considerably enlarged, and felt knotty from the stools so long retained. The end of the forefinger could barely reach the plug on account of the inflamed and swollen state of the gut which had begun to suppurate. The ordinary instruments were unavailing for its removal, and a peculiar pair of forceps were invented for the purpose, and fitted upon it with a screw. The operation was very painful, and required much force. In the course of a fortnight he completely recovered.

A case is reported by Johnson (*c*) of a man who died immediately after being admitted into King's College Hospital; he had been labouring under obstruction of the bowels for five days, having eaten a large quantity of peas on the previous day; and during the last three days had also suffered from retention of urine. During the whole time he had had severe pain in the belly, costiveness, and bilious vomiting; purgatives were given without relief; and when admitted he was much debilitated, his features pale and shrunken; skin cold, and pulse feeble. On *examination*, the bladder was found distended, its base nearly at the brim of the *pelvis*, and its top reaching to the navel. The intestines were distended with air; but the *rectum* contained upwards of a pint of gray peas, which had been swallowed dry and almost without mastication, and had not undergone any other alteration than becoming swollen; some were mixed with stool in the *colon*, but the greater number were on the *rectum*, where they formed a solid mass, occupying almost the entire pelvic cavity, pushing up the bladder and prostate, and compressing the *urethra*, so that there was considerable difficulty in passing the catheter.

(2) Brodie (*d*) mentions the case of a person who had obstruction of the *rectum*, caused by a piece of apple core which he had swallowed on the day previous. Welbank tells me that on a similar occasion he pulled out a piece of *vertebra* and rib about an inch and a half long, part of a mutton chop which had been unwittingly swallowed.]

1751. The symptoms occurring under such circumstances are, obstruction, or entire prevention of passing stools, very severe *tenesmus*, great

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(*a*) London Med. Gaz., vol. xxix. p. 846. 1842.

(*b*) Ibid., vol. xxx. p. 462. 1842.

(*c*) Ibid., p. 605.

(*d*) Ibid., vol. xvii. p. 27. 1836.

inflammation, and swelling of the inner wall of the *rectum*, extending to the neighbouring parts and to the bowels, violent fever, *tympanitis*, and the like. The danger is always great, and the foreign body must be removed as quickly as possible. The removal is often exceedingly difficult, on account of the seat and form of the foreign body, and the degree of inflammation and spasmodic contraction of the *sphincter*.

[Abscesses by the side of the *rectum* are occasionally formed by hard substances, which have been swallowed, making way through its wall. **Brodie** (*a*) mentions an instance in which a very large abscess was found; it was opened, and sticking across it was a long fish-bone, which he extracted. **Green** tells me another instance of a female, in whom the abscess was so distended with pus, that when punctured it flew across the room; from it part of the *pelvis* of a snipe was removed.

But still more serious consequences than abscess occasionally happen when a foreign body remains fixed in the *rectum*; it may cause complete closure of this gut, as in a case which occurred to **Coulson**. The woman, previously in good health, was thirty-four years of age, and between the fourth and fifth month of her pregnancy, when she was attacked with sickness, constipation, pain, and distension of the belly. These symptoms increased in severity, fæcal matter was rejected from the stomach, the belly became more distended, and no relief from the bowels could be obtained, injections which were attempted to be thrown up the *rectum*, being immediately expelled. She gradually sunk, and on the ninth day from the commencement of the attack, died. On *examination*, the *colon* was found exceedingly distended, especially its descending part, and between three and four inches from the *anus*, a foreign body, believed to be a small portion of fish-bone, found adherent to the lining membrane of the *rectum*, and in this situation pressed on by the gravid womb. Immediately below the bone, the gut was completely closed to the extent of three inches. The preparation is in the College Museum.]

1752. When the position of the body in the *rectum* has been ascertained by the introduction of the left forefinger oiled, a pair of polypus or stone-forceps are to be introduced upon it, the foreign body seized and withdrawn. The removal may be always facilitated by injecting oil into the gut. In violent inflammation, blood-letting should be resorted to, and in spasmodic contraction of the *sphincter*, suppositories, with the addition of extract of *belladonna* or *hyoscyamus*. In a case in which the size of the foreign body was very great, a pair of forceps with a movable lock were employed, so that each blade could be separately introduced (*b*). In case of a very frangible body, as glass and the like, in which danger was dreaded from its pieces, the hand of a child was employed for its removal (*c*). The use of the various anal specula can render easy the grasping foreign bodies; but the force accompanying the use of these instruments, renders them dangerous, if there be much inflammation. In these cases it is better to cut through the *sphincter ani*, and thereby relieve the obstruction which prevents the removal of the foreign body. (**Delpech.**)

Marchettis (*d*), in a case in which a swine's tail, with the thick end upwards, had been introduced into the *rectum*, used a hollow tube, which protected the inner membrane of the *rectum* from injury.

[**Custance** (*e*) mentions the case of a man who fell on an inverted blacking pot, and had the whole of it forced up the *rectum*. Attempts were made for an hour and a half to dilate the *sphincter*, and remove it with forceps, but in vain. The small end of an iron pestle was then introduced, till it touched the bottom, and being held there firmly, was struck with a flat iron. At the second blow, the pot was broken into several pieces, which were removed piece by piece with the forceps, or with the fingers. Next morning he laboured under severe intestinal inflammation, with incessant vomiting and excruciating pain over the whole belly; and he died at night. The pot was two inches and three eighths at the brim, an inch and a half at its base, and two and an eighth in depth.

(*a*) London Med. Gaz., vol. vii. p. 27. 1836.

(*b*) **Messerschmidt**; in **Walther**, above cited.

(*c*) **Nolet**; in **Morand**, above cited.

(*d*) In **Morand**.

(*e*) London Medical Gazette, vol. iv. p. 18. 1829.

Lawrence had a case in which a man had broken the neck of a wine-bottle into his *rectum;* he gradually dilated the *sphincter*, introduced his whole hand, and removed it.]

VI.—OF FOREIGN BODIES IN THE LARYNX AND WINDPIPE.

Hevin, Précis d'Observations sur les Corps étrangers arrêtés dans l'Œsophage, et dans la Trachée-artère, etc.; in Mém. de l'Acad. de Chir., vol. i. p. 565.

Louis, Mémoires sur la Bronchotomie—Second Mémoire sur la Bronchotomie, où l'on traite de Corps étrangers dans la Trachée-artère; in Mém. de l'Acad. de Chir., vol. iv. p. 455.

De la Martinière, Observations sur un Corps étranger qui perçoit la Trachée-artère; in Mém. de l'Acad. de Chir., vol. v. p. 521

Lescure, Sur une portion d'Amande de noyau d'abricot, dans la Trachée-artère; in same, p. 524.
Suite d'Observations sur les Corps étrangers dans la Trachée-artére; in same, p. 527.

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Stokes, William, M.D. A Treatise on the Diagnosis and Treatment of Diseases of the Chest. Dublin, 1827. 8vo.

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Klein; in Chirurgisch. Bemerkung. Stuttg., 1801; in von **Siebold's** Chiron., vol. ii. p. 649; in von **Graefe** und von **Walther's** Journal, vol. i. p. 441; vol. vi. p. 225.

Michaelis; in **Hufeland's** Journal, vol. ix. pt. ii.; vol. xi. pt. iii.

Pelletan, Mémoire sur la Bronchotomie; in Clin. Chir., vol. i. p. 1.

Lawrence, Will, On some Affections of the Larynx, which require the operation of Bronchotomie; in Med.-Chir. Trans., vol vi.. p. 221.

1753. Foreign bodies usually get into the windpipe, when during the act of swallowing, the *epiglottis* is raised by speaking, laughing, and the like, or when they are thrown into the mouth. The symptoms produced depend on the obstructed passage of the air, and the irritation of the lining membrane of the windpipe. Immediately there occurs a severe convulsive cough, with danger of choking, with a whistling and rustling in the throat, which sometimes relaxes for a space; the patient points to the seat of pain with his finger, has more or less painful effort in swallowing and in breathing; his voice is altered and becomes hoarse, or is completely lost; by the obstructed return of the blood from his head, the face at last becomes puffy and bluish, the eyes start out, the veins of the neck are swollen, and above the collar-bones there appears an emphysematous swelling. These symptoms sometimes continue with the same violence, sometimes cease, but recur at irregular periods; occasionally only some of them diminish, considerable pain, oppression, and difficulty of breathing remain. The consequences specially to be feared from foreign bodies in the windpipe are, suffocation, if the entrance of the air be completely prevented; *emphysema* of the lungs if the position of the body prevent the escape of the air; inflammation of the windpipe and lungs with their outlets, and apoplexy from the collection of blood in the brain.

[**Porter** (*a*) well observes:—"This accident never happens at the time it is generally considered as most likely to occur, namely, in the act of swallowing. When a person is engaged in the performance of this function the root of the tongue is depressed, whilst

(*a*) Above cited.

the *larynx* is elevated; the *epiglottis* is thus mechanically thrown as a bridge across the *larynx*, and so effectually closes it that the smallest morsel, or even a drop of water, can find no admission. * * * But it is different when a man attempts to draw a full inspiration whilst any foreign body is within reach of the current of air about to pass into the lungs. At this time the *epiglottis* is raised, the *rima glottidis* is distended, and everything appears to favour the entrance of the air, and, of course, of whatever it bears along with it. Thus, a person holding a sup of wine in his mouth to enjoy the flavour, incautiously attempts to breathe, a drop of the fluid enters the *larynx*, it produces great irritation and the spasmodic cough that ensues throws it out with great violence, perhaps even through the nostrils." (pp. 184, 185.)

One of the most remarkable instances of a foreign body getting into the windpipe without passing through the *rima glottidis* is mentioned by De la Martinière (*a*). A child, nine or ten years of age, amusing himself with cracking a small whip, was suddenly seized with extreme difficulty of breathing, and soon exhibited all the symptoms of approaching suffocation. He complained, by gesture, of some impediment in the *trachea*. The Surgeons who saw him, aware that he had never been left alone, and that he could not have put anything into his mouth, did not suspect the existence of a foreign body impeding respiration." He was bled, the throat examined, and an œsophageal bougie passed, without making any discovery. The symptoms became more urgent, and De la Martinière saw him an hour after. "On examining the neck externally, I found," says he, "a small red spot on its fore part, like the middle of a flea-bite, immediately below the cricoid cartilage, and beneath it was felt deeply a little circumscribed ganglion as large as a lentil, corresponding to the red spot, and of unnatural brightness; the sensation could not have been more distinct through the thickness of the parts. I at once determined to cut through the skin and fat upon this spot. The finger having been introduced into the wound, and touching the tubercle, which was close to the windpipe, I deepened it with a second stroke of the knife, and laid bare the cartilaginous rings of that tube. I felt with my nail an irregularity, projecting at least a line above its convexity, and endeavoured in vain to seize it with the dressing forceps. Luckily I had with me a pair of hair-nippers, and with these caught hold of the body, which I drew out, and, to my great surprise, found it to be a large copper pin without a head, about an inch and a quarter long, which had pierced through the windpipe from left to right." The child got well in a few days.]

1754. The difference of the symptoms depends on the particular seat, form, and condition of the foreign body. If situated in the *rima glottidis*, and completely closing it, the patient is suffocated, if not quickly relieved, or the foreign body do not change its place by the violent inspiration and expiration, which, however, is rarely the case, on account of the spasmodic contraction of the *rima*. If the *rima* be not completely closed by the foreign body, violent convulsive cough comes on, and the patient points to the seat of the body with his finger. A foreign body, if not of large size, may remain lying in either of the laryngeal ventricles. Its symptoms are at first less severe, but the continued residence of the foreign body will, in the end, be fatal (1). If it be loose in the windpipe, it moves up and down with every inspiration and expiration; symptoms come on at intervals; the pain is severe; changes its place; the cough is frequent and convulsive, so that, in very rare cases, the foreign body is coughed out; danger of suffocation occurs if it be forced up against the *rima glottidis*. Foreign bodies rarely drop into either *bronchus* (2). Pointed rough bodies cause violent symptoms; the mucous membrane of the windpipe inflames, swells, and the passage narrows where the foreign body is fixed. The same happens with those bodies which swell with moisture. In rare cases the foreign body, after remaining a long while in the air passages, and producing symptoms of *phthisis*, is thrown out, and the case terminates satisfactorily (3).

[(1) A foreign body, to be lodged in the ventricles of the *larynx*, must be extremely small; and I apprehend such as are generally described as so situated are not so, but only

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(*a*) Mém. de l'Acad., above cited.

in the body of the *larynx*, of which there are two examples in the Museum of St. Thomas's Hospital. In one a piece of mussel-shell lies lengthways in the left side of the *larynx*, with its upper end jammed into the base of the *epiglottis*. I cannot get more information of it than that the child lived a fortnight after the accident. The other, a case related by **Bullock** (*a*), was a girl of six years, who swallowed a pebble. "She was seized with a most violent convulsive cough, so that she became black in the face and was nearly suffocated; the paroxysm continued for half an hour and then subsided. The throat was examined, and an œsophageal probang introduced, but without, however, discovering any extraneous body. The three or four following days the child merely complained of a sense of soreness in the throat with nausea, which was accompanied by occasional slight paroxysms of cough with a copious mucous expectoration; she was also hoarse, but had no pain or difficulty in deglutition. Aperients and an emetic were prescribed; she was not benefited, and, as she still persisted that the stone remained in the throat, was again, on the fifth day, very carefully examined, yet there did not appear to be any evidence of its existence either in the *œsophagus* or *trachea*." As she had not had hooping cough and was constantly playing with children who were labouring under that disease, it "appeared to warrant the conclusion that no foreign body had passed either into the *œsophagus* or *trachea*, and that the cough was among the first symptoms of a severe form of *pertussis*. At the end of the fifth day she had marked symptoms of inflammation of the mucous membrane of the *bronchi*, namely, cough, generally occurring in paroxysms six or seven times a day, attended with a kind of whooping inspiration and a copious expectoration of tenacious mucus; the hoarseness was likewise increased, while over the *trachea* and upper part of the chest there was a loud mucous rattle, which was in part sonorous." Leeches, and calomel, and antimony were used for some days, and in a month from her first attack she was stated to be "quite well," having regained her flesh and healthy appearance. A fortnight after this, however, "she was attacked with symptoms of *pneumonia*," and she died in twelve days, "eight weeks from the supposed accident; but from the time she was reported quite well to the day of her death there was no return of the convulsive cough nor any uneasiness about the throat. On the day of her death, however, she again said she could still feel the stone, and in the same place as at first. *Examination.*—On laying open the *larynx* and *trachea* a quartz pebble was exposed, lying partly in the cricoid cartilage and partly in the *trachea*, of the size of a horse bean, of irregular figure and smooth surface; it was retained in its situation by a layer of apparently organized lymph of very considerable thickness. On removing the stone the mucous membrane was in a state of ulceration (and the front of the thyroid and cricoid cartilages bare.—J. F. S.) The calibre of the tube was so nearly obstructed by the presence of the stone and lymph as to render it difficult to pass an ordinary-sized probe downwards. The whole of the mucous membrane of the *trachea* was thickened and its vessels congested. About a pint of turbid fluid was in the right *pleura*, containing flakes of adventitious membrane, with which the *pleura pulmonalis* of that side was also covered. Nearly the whole right and the lower part of the left lung were in the several degrees of hepatization and purulent infiltration. (p. 952.)

(2) When the weight of the foreign body has carried it low down into one of the *bronchi*, most commonly the right on account of its larger size, as first noticed by **Key**, it may block up the passage so completely that no air, or but little, can pass into the lung below it, and consequently it remains fixed by its own gravity, causing pain in the chest opposite the part where it is lodged, which is increased on deep inspiration, and is accompanied with "a catching." Violent cough and a disposition to vomit, or actual vomiting, occur immediately after the accident, but after a time subside, and an occasional dry cough comes on at irregular periods, and in the intervals the patient may be tolerably well and able to follow his ordinary occupation, or the symptoms may become more urgent, may be accompanied with repeated attacks of *hæmoptysis* and terminate in *phthisis*, even although the foreign body have been coughed up after having been retained weeks or months. Some remarkable cases of this kind will be presently referred to.

(3) The time which a foreign body, after the first severe symptoms have passed by, may remain lodged in the air passages varies very considerably. The longest period of which I am aware is that of the female mentioned by **Sue** (*b*), who when in her ninth year, had the rump-bone of a pigeon slip into her windpipe; she became subject to attacks of *hæmoptysis* and other symptoms of pulmonary disease, but without wasting, till her twenty-fourth year, when she began to decline rapidly. Two years after she threw up the bone in a violent fit of coughing; but she died eighteen months after with

(*a*) London Medical Gazette, vol. xviii. 1836.

(*b*) Mém. de l'Acad. de Chirurgie, vol. v. p. 533.

profuse purulent expectoration. **Dupuytren** (*a*) gives an account of a man who lived ten years, after a small coin had got into his air-tube, and on examination it was found embedded in a tubercular cavity in the lung. **Louis** (*b*) also relates another case, in which after swallowing a louis-d'or, a man lived six years and a-half, and then died with his right lung completely destroyed by suppuration. My friend **Sutton**, of Greenwich, has mentioned to me a case of *hæmoptysis*, which he attended many years since. The man had frequent attacks for more than a twelvemonth, from each of which, however, he rapidly recovered. Upon the last occasion, he was summoned suddenly to see the man, who was said to be in a dying state. On his arrival he found the patient had had a very severe attack of *dyspnœa*, and threatening suffocation, from which, however, he had been immediately relieved on rejecting from his windpipe a common lathe nail, much corroded. The man was a plasterer by trade, and now remembered that some time before first requiring **Sutton**'s assistance, he had swallowed a nail whilst lathing a ceiling, but had thought no more about it till it was thrown up. He died some years after of diseased lungs. Dr. **Paris** (*c*) relates the case of a girl twelve years old, who "having put a small cowrie shell in her mouth, was seized with a violent choking fit, in consequence of its having been supposed to have gone the wrong way in the act of swallowing it. The spasmodic paroxysm was described as most alarming, and continued for several seconds, which induced her father to thrust his finger with considerable force down her throat, which afforded immediate relief, and therefore convinced him that he had thrust the foreign body into the *œsophagus*, and that it had passed into the stomach. * * * In the course of four or five days a slight cough came on, but it was not characterized by any symptom which would lead to the suspicion of it having been provoked by the presence of any foreign body in the air passages, and this opinion was confirmed by its speedily yielding to the ordinary treatment." Between three weeks and a month after she had "a return of the cough much more violent than usual, and accompanied with slight *hæmoptysis*. This, however, again subsided, and she remained for many months in perfect health; her breathing was never disturbed, she indulged in her usual active habits and daily exercise, and declared that she was perfectly well. * * * About twelve months after, she had danced at a ball during the whole evening, and at its conclusion, in the act of moving briskly, she was suddenly attacked by a violent spasmodic cough, which threatened suffocation, when by a sudden and convulsive expiration, a substance was ejected from her mouth with such force as to be carried to a considerable distance. This proved to be the remnant of the shell, the animal principle of which had disappeared, and its earthy matter alone remained." (pp. 116, 17.) In the younger **Travers**'s case (*d*), a girl of six years, who was suddenly thrown back whilst eating cherries, "was immediately seized with a violent fit of choking and every symptom of impending suffocation. This condition lasted an hour, and then she fell asleep." On the next day she had some spasmodic pain in the chest, and on the following "morning the breathing was very difficult, and other symptoms of inflammation present," which were relieved by blood-letting, a calomel and jalap purge, and calomel and opium. On the afternoon of the fourth day "she had a violent convulsive seizure, with cough, small quick pulse, a livid surface, suffused eye, and every sign of threatened suffocation. It was stated in evidence of the violence of the spasm, that the stools and urine 'flew' from the child during these attacks." She grasped and pulled her throat in a peculiar manner, "crying in a half whisper 'take it out! take it away!' The spasm subsided after two hours' continuance," and a few hours after she was so tranquil as to lead to the belief "that no stone could have passed into the *trachea*." In the middle of the following day the fit recurred, with "violent jactitation and abundant flow of frothy mucus from the mouth. When it had subsided, the probang was introduced, and the child swallowed with greater facility." On the seventh day there came on a similar attack; on the thirteenth, and from that time daily, till the nineteenth day, when **Travers** saw her, and she had then "frequent paroxysms of croupy cough, attended by great restlessness and the peculiar grasping of the throat." Under these circumstances, he performed tracheotomy; but the stone was not thrown out; the breathing, however, became tranquil, and the cough also ceased. It returned, however, on the twenty-sixth day, but less severely. About six weeks after, the wound, which had been tented healed, and soon after "the child coughed incessantly, had night sweats, with loss of strength and appetite." In this condition she continued till the ninety-sixth day after the accident, when she threw out "the stone, together with a table-spoonful of pus, during a violent paroxysm of cough; having expectorated pus in small quantities for many days previous. From this time the cough never returned, and the general health was soon re-established." (p. 108–12.)

(*a*) Leçons Orales, vol. iii. p. 584.

(*b*) Mem. de l'Acad. de Chir., vol. v. p. 529.

(*c*) Med.-Chir. Trans., vol. xxiii 1840.

(*d*) Ibid.

1755. As foreign bodies in the *œsophagus* produce the same symptoms as those in the windpipe, it is always necessary, by examination of the throat, by the introduction of a sound, with a piece of sponge upon its end, to be sure of the *œsophagus* (1).

Foreign bodies are only in very rare instances, thrown out by violent coughing: on this account a severe emetic or artificially excited sneezing increase the danger (2).

The only remedy for the certain removal of the foreign body is *opening the windpipe, (Bronchotomia, Tracheotomia,)* or *opening the larynx, (Laryngtomia.)* This operation must be undertaken as quickly as possible, because if put off, such symptoms as violent inflammation of the lungs and windpipe, *emphysema* of the lungs and the like arise, which even after the removal of the body may cause death. The operation is in all cases required, where suffocation presses, or an asphictic condition has set in; further, if dangerous symptoms occur from time to time, and the foreign body be observed rolling up and down in the windpipe; or if fixed pain point out its exact seat. But if the patient be free from all these symptoms, and the seat of the foreign body cannot be discovered, we must wait till there are symptoms of change in its situation, and a possibility of its removal.

[(1) In reference to this subject Stokes (*a*) mentions one instance in which a piece of money lodging in the *œsophagus* produced croupy breathing and laryngeal symptoms. And in his Lectures he used to speak of another case in which such symptoms were produced by a foreign body (a plum-stone) in the *œsophagus*, that his first impulse was to perform tracheotomy with his penknife. An œsophageal bougie was, however, introduced, and the substance having been pushed into the stomach, the symptoms ceased, and a day or two after the plum-stone, with which the child had been known to be playing previous to the accident, was voided by stool (*b*).

(2) Occasionally it may happen that although violent fits of coughing having failed to expel the foreign body from the windpipe, yet by some accidental change in the patient's position, the foreign body is removed from its lodging place, and is then thrown up with little effort. Such seems to me the explanation of Cock's case (*c*) of a sixpence slipping down the throat, and at first lodging in the *larynx*; "violent coughing, wih the most distressing sense of suffocation, immediately took place, and during the paroxysm he threw up a quantity of blood. On his admission he was still struggling for breath, coughing incessantly, and suffering great pain and irritation, which he referred to the *larynx*, where the coin appeared to have lodged." Shortly after "the sixpence had left the *larynx*, and descended into the *trachea*; its change of position being immediately followed by an abatement of the previous urgent symptoms. He still coughed almost incessantly, stated that he could feel the sixpence moving up and down the windpipe, and complained of pain and soreness in the chest in the seat of the right *bronchus*, and also just below the *larynx*." Towards the end of the same evening the symptoms subsided, and he went to sleep. On the following day he was in much the same state, and "as long as he remained calm and quiet, he complained of nothing but a feeling of general soreness along the *larynx* and windpipe." The same evening the sixpence was thrown out without surgical aid. "I was asleep," said the patient, "and dreamed I was drinking a pot of porter, and the attempt to swallow it made me cough. I awoke, and found the sixpence in my mouth." Cock observes:— "It is perhaps worthy of remark, and not destitute of practical interest, that the foreign body, which had retained its position during the most violent expiratory efforts, should at length be ejected, at a period when the muscles of the *glottis* were probably in a state of quietude, and being taken unawares, allowed its expulsion, under a gentle act of coughing." (pp. 554, 55.)]

1756. Opening the *larynx* or windpipe is also required to assist the entrance of the air into the lungs, when it is obstructed under any other circumstances, and suffocation is dreaded; in great swelling or other

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(*a*) Above cited, p. 265.

(*b*) Wells; in Dict. of Pract. Surgery, vol. i. p. 516.

(*c*) Medical Gazette, vol. i. New Series, 1845.

degeneration of the structures about the throat; in diseased changes of the *epiglottis;* in great swelling of the tongue, if the danger cannot be relieved by bleeding, scarification, and the like; in fracture of the thyroid cartilage, if the dislocated pieces cannot be otherwise brought into place; in inflammation of the *epiglottis (Angina laryngea)*; when foreign bodies are in the *œsophagus*, and cause suffocation; in compression of the windpipe by tumours; in gun-shot wounds of the throat, which, on account of the great swelling, are attended with danger and suffocation; in drunken or suffocated persons; in croup, if the membrane be loose and cannot be coughed up.

According to DESAULT (*a*), in the greater number of these cases in which it is only necessary to assist the entrance of the air, the introduction of an elastic tube through the nostril renders the operation superfluous. No other person, however, but DESAULT holds this notion. SAMUEL COOPER (*b*) objects to it in drunkards and suffocated persons, and considers opening the windpipe to inflate the lungs, most efficient. However, the benefit of cutting into the windpipe, undertaken in this spirit, is not supported by precise reasoning.

In *Angina laryngea*, which is characterized by difficult breathing, with pressing suffocation, very hoarse and only whispering voice, and frequently accompanied with pain in the *œsophagus* and difficulty in swallowing, without apparent swelling and redness of the throat, the operation must not be long delayed, if relief be not soon afforded by general and local blood-letting, blisterings, and the like (*c*). In *Angina membranacea*, laryngotomy and tracheotomy are generally useless, because the mass blocking up the air-tube, is not merely in the *larynx*, but extends through the whole windpipe and even into the *bronchi* (*d*). In more modern times, however, many cases have been published in which this operation has been successful.

NEVERMANN (*e*) has collected all the cases of *laryngitis* and *trachæitis*, in which tracheotomy has been performed; and the result is that out of one hundred and forty cases, twenty-eight have been cured, and one hundred and twelve died.

BRETONNEAU (*f*) considers that tracheotomy can only terminate favourably, if the opening be made moderately large between the thyroid gland and the breast-bone, and the free entrance and escape of the air maintained by a sufficiently large and wide canula. At the same time he introduces calomel dry, or moistened with water, through the wound into the windpipe. In one case he succeeded.

TROUSSEAU (*g*) also recommends the introduction of a thick catheter, and scraping out the windpipe with a probang, and dropping in a watery solution of nitrate of silver, four grains to a dram of water. GERDY (*h*) also advises the introduction of a weak solution of lunar caustic.

[KIRBY (*i*) is decidedly opposed to bronchotomy for croup; he says:—"I have performed the operation myself on the child, and have seen it frequently done by others, and in no one case has the life of the patient been saved." (p. 63.)]

1757. The proceedings vary in laryngotomy and tracheotomy, in reference to the special object desired, according as the entrance of the air is to be assisted, or a foreign body removed.

1758. In laryngotomy, after placing the patient's head in such a position as that his uneasiness shall be least, and the front of the neck free and accessible, the skin is to be moderately stretched on both sides with the fingers of the left hand, and the *larynx* at the same time fixed; a cut is then made lengthways, about an inch in length, the middle

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(*a*) Above cited.

(*b*) Dictionary of Practical Surgery, p. 1262.

(*c*) FARRE; in Med.-Chir. Trans., vol. iii. p. 84. —PERCIVAL, E.; Ibid., vol. iv. p. 29.—WILSON, THOMAS; Ibid., vol. v. p. 155.—ARNOLD; Ibid., vol. ix. p. 31.—HALL, MARSHALL; Ibid., vol. x. p. 166.—PORTER; Ibid., vol. xi. p. 114—WEDEMEYER; in VON GRAEFE und VON WALTHER'S Journal, vol. ix. p. 107.

(*d*) SACHSE, vol. ii. p. 277; the best writer on Croup.

(*e*) Berliner Med. Centralzeitung, 1836, July.—Also, CULLEN, V., On the Causes of the Fatal Termination of certain cases of Bronchotomy; in Edinb. Med. and Surg. Journal, vol. xxix. p. 75, 1828.—BECQUEREL; Bulletin de Therapeutie, 1842, Jan., Feb.

(*f*) Des Inflammations spéciales du Tissu muqueux et en particulier de la Diptherite, ou inflammation pelliculaire, connue sur le nom de Croup, d'Angine maligne, d'Angine gangrèneuse, p. 217—395. Paris, 1826. 8vo.

(*g*) Journal des Connaissances Med.-Chirurg., 1834, June.

(*h*) Archives générales de Médecine, vol. v. p. 577, 1834.—STILLING; in Berlin Med. Centralzeitung, 1835, May 9.

(*i*) Observations, cited at the head of article.

of which corresponds to the crico-thyroid ligament. A second cut divides the cellular tissue between the sterno-hyoid and sterno-thyroid muscles, and lays bare the crico-thyroid ligament; the bleeding must be stanched with a sponge dipped in cold water. The *larynx* is then to be fixed with a finger on each side, and the forefinger of the same hand placed on the upper third of the ligament; after which a lancet is thrust in, and a wound of sufficient extent made, which is to be kept open by inserting lint between the angle of the skin and of the muscular wound, and the whole covered with gauze, and the patient allowed to bend his head towards the chest.

This method appears preferable to using the tracheotome and introducing a tube into the aperture made in the crico-thyroid ligament, for the tube always excites inconvenient, and frequently unbearable irritation, is frequently stopped up, and cannot be properly fastened. The cases in which cutting into the windpipe is performed are urgent, and the tracheotome cannot be sufficiently commanded. If the opening into the crico-thyroid ligament be insufficient, the cut must be lengthened through the cricoid cartilage. For the purpose of effecting expectoration, if much tough mucus collect, the wound must occasionally be held with the fingers, and the patient allowed to cough. If a canula be used, it should always be sufficiently large.

For the purpose of avoiding an often not inconsiderable arterial branch upon the crico-thyroid membrane, we must feel with the finger if the membrane be quite bare, and when it is exposed, we must endeavour to avoid it, for which purpose the membrane is to be divided transversely at the upper edge of the cricoid cartilage.

[Some persons are in the habit of introducing a tube into the *larynx* after having opened it. This as a general rule is quite unnecessary, as if there be any fear of the wound closing before the air can recover its usual course through the *rima glottidis*, it is better to cut out a piece of either the laryngeal or tracheal cartilage, as may be, according to LAWRENCE's recommendation. And it is also improper, as a fistulous opening will be formed, which on the subsequent removal of the canula, may contract so as to require a second operation, and often cannot be done without. If, however, such practice be adopted, it will be necessary that the instrument should be taken out from time to time to ascertain that it has not been corroded; for if not, it may break, and the part within drop down the windpipe, whilst that without falls from the wound, without notice. A case of this kind was admitted into St. Thomas's Hospital in December, 1844; a tube had been introduced about two and a half years previously, and on the morning of his admission whilst walking along the street, it slipped out broken. No symptoms of consequence, however, appeared till towards evening, when the breathing became difficult, and attended with a whistling noise; the veins of his head and face distended, and the surface covered with cold perspiration. My colleague and assistant, the younger TRAVERS, therefore, thought it necessary to pare the edges of the opening, and dilate it upwards and downwards upon a director. Some blood running into the windpipe caused violent expirations, and in one of them two fragments, which formed the remainder of the canula, were expelled, surrounded with a clot of blood, and the relief was immediate. Another canula was introduced. The patient did well; and the broken corroded instrument is in St. Thomas's Museum.

Occasionally it happens that after a severe cut throat, the aperture remains, from some cause or other, fistulous; and as the scar contracts, the passage for the air is so narrowed as to cause great difficulty of breathing, and require surgical aid. I had a case of this kind some years ago, in a Hindoo woman, who, in her voyage to this country, had attempted suicide, and nearly cut through the *larynx*, between the thyroid and cricoid cartilages. She had been very refractory, and the skin had turned over the lower edge of the wound, and become connected with the back of the organ, so as materially to diminish the passage, and cause her breathing to be very laborious, and with a loud hiss. As from the account given, these symptoms were daily becoming worse, I cut through the front of the cricoid cartilage vertically, and inserted a short but pretty wide tube, through which she breathed freely and did well, leaving the house some time after to return home.—J. F. S.]

1759. If laryngotomy be undertaken for the removal of a foreign body, the crico-thyroid ligament is, after the bleeding has been stanched, to be cut through its whole length, from the thyroid to the cricoid cartilage; and if this be insufficient to allow the foreign body to be removed or withdrawn through it, a director somewhat curved is to be introduced, by means of which a button-ended bistoury is passed in, and the thyroid cartilage sufficiently divided upwards in its centre, or the cricoid cartilage, and the upper part of the air-tube so far cleft as the removal of the foreign body may seem to require.

1760. After the opening is made, if the edges of the wound be gently drawn apart with blunt hooks by the assistants, the foreign body usually appears and is thrown out by coughing; but if this do not happen, its position must be sought with due care, and it must be removed with straight or curved forceps. The treatment, after removal of the foreign body, must be precisely similar to that already laid down for longitudinal wounds of the windpipe. (*par.* 467.)

1761. In tracheotomy, where the entrance of the air merely is to be assisted, a cut should be made through the skin and muscle on the mesial line of the windpipe, beginning below the cricoid cartilage and continued down to the edge of the breast-bone. The edges of the wound are to be held asunder with blunt hooks, the blood sopped up with a moist sponge, the cellular tissue and vascular net upon the third and fourth cartilaginous rings divided, and thus the windpipe laid bare. Bleeding is stanched by cold water, or, where possible, by tying the vessels; the lobes of the thyroid gland, which are a little in the way, are to be turned aside, and two or three rings of the windpipe divided vertically. The further treatment is the same as after opening the *larynx*.

The same reasons against the use of the tracheotome and the introduction of a tube, which have been already given (*par.* 1758) also apply here. LAWRENCE (*a*) advises, if after opening the windpipe, the introduction of the tube cannot be effected, to cut off half an inch through the cartilage, and to remove a small slip from the edges of the wound, so that the opening may continue to gape.

1762. If tracheotomy be performed for the removal of a foreign body, the air-tube must be exposed and cut into in the way just described, only the size of the cut must be proportioned to that of the body to be removed. The removal itself must be managed as in laryngotomy.

[When the foreign body is lodged in the *bronchus* its removal should be first attempted by reversing the patient's natural position, and placing him upright, or nearly so, with his head downwards, and then striking his back or shaking the body smartly, by which it may be hoped the foreign substance will move from its situation, and, dropping through the windpipe, be ejected at the *rima glottidis*. Of the two very interesting cases in which this practice was successfully adopted, BRODIE's patient (*b*) had first attempted it on the sixteenth day after the accident, by "placing himself in the prone position, with his *sternum* resting on a chair, and his head and neck inclined downwards, and, having done so, he immediately had a distinct perception of a loose body slipping forward along the *trachea*. A violent convulsive cough ensued. On resuming the erect posture he again had the sensation of a loose body moving in the *trachea*, but in an opposite direction, that is, towards the chest." The experiment was repeated six days after, more completely; "he was placed, in the prone position, on a platform, made to be movable on a hinge in the centre, so that on one end of it being elevated, the other was equally depressed. The shoulders and body having been fixed by means of a broad strap, the head was lowered until the platform was brought to an angle of about 80 degrees with the horizon. At first no cough ensued; but on the back, opposite the right *bronchus*, having been struck with the hand, the patient began to cough violently; the half-sovereign, however, did not make its appearance. This process was twice repeated with no better result; and on the last occasion the cough was so distressing, and the appearance of choking was so alarming, it became evident it would be imprudent to proceed further with this experiment unless some precaution were used to render it more safe." Tracheotomy was therefore determined on two days after, and "in proposing this," says BRODIE,

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(*a*) Above cited, p. 249.

(*b*) Above cited.

"we had a twofold object; the one, that if the coin were lodged in any part from which it might be safely extracted by the forceps, this method might be had recourse to; and the other, that, if relief could not be obtained in this manner, the artificial opening might answer the purpose of a safety valve, and enable us to repeat the experiment of inverting the body on the movable platform without the risk of causing suffocation." The operation "being completed, some attempts were made to reach the coin with the forceps introduced through the opening. The contact of the instrument with the internal surface of the *trachea*, however, induced on every occasion the most violent convulsive coughing. The coin was not seized, nor even felt." The attempt was therefore given up for the time, and repeated five days after with no better success. He was left quiet for ten days to recover from the exhaustion he suffered, and the probe was passed occasionally into the wound to keep it open. At the end of this period, on the thirtieth day after the accident, "the patient having been placed on the platform, and brought into the same position as formerly, the back was struck with the hand; two or three efforts to cough followed, and presently he felt the coin quit the *bronchus*, striking almost immediately afterwards against the incisor teeth of the upper jaw, and then dropping out of the mouth. A small quantity of blood, drawn into the *trachea* from the granulations of the external wound, being ejected at the same time. No spasm took place in the muscles of the *glottis*, nor was there any of that inconvenience and distress which had caused no small degree of alarm on the former occasion. (p. 288–91.) The case did well. Macrae (*a*) did not make any opening into the air-tube of his patient, but, on the third day after the mishap, had him "strapped securely to a common chair, that he might be easily suspended from the rafters of the roof, with his head downwards, in order that his chest might be conveniently shaken by a rapid succession of sudden smart jerks, and that the weight of the bullet might favour its escape from its seat in the lungs. He was kept depending as long as he could endure such an uncomfortable position, and then placed in the horizontal posture for a few minutes to rest. When sufficiently recruited he was hung up again. Upon being taken down the first time he described the pain in his breast as having moved nearer to the top of his chest; and during the third suspension he joyfully exclaimed, "thanig à! thanig à!" ("it has come! it has come!" in the Gaelic language,) immediately after a smart shaking and a few convulsive retching coughs, and spat the little bullet from his mouth. The diameter of it is three eighth parts of an inch, having its surface ruffled by the chewing it underwent previously to slipping into the windpipe. He felt immediate relief from every uneasy feeling, except the dry cough and deep-seated pain in his breast, which continued rather sharp for two days, after which, and a dose of laxative medicine, he found himself restored to his former health, and by the end of the week pursued his usual avocations on the hill." (pp. 421, 422.)

If this mode of treatment be insufficient to dislodge the foreign body from the *bronchus*, it will be necessary to attempt its removal by opening the windpipe and drawing it out with forceps. This operation was first performed, and successfully by Liston in 1833 (*b*), on a female of thirty-eight years, who "got a piece of mutton bone entangled in the *glottis*, whilst eating some hashed meat. By a great effort, during a fit of threatened suffocation, she succeeded in dislodging it; but it passed downwards into the *trachea*," * * * and lodged permanently under the right sterno-clavicular articulation. An attack of *bronchitis* supervened, followed by cough and expectoration, and the inflammatory attack was repeated several times; from one of these she had just recovered. * * * The inspiration was somewhat noisy, and there was some degree of peculiar sonorous râle perceived on applying the ear to the chest at the point described as where the foreign body had become fixed. The operation was performed; one pair of forceps opening laterally were introduced: a hard substance could be felt, but not grasped; the patient was re-assured, and allowed to recover the effects of the exploration and attempt to seize it. Another instrument with the blades differently arranged, was then passed down the tube, at least three or three and a half inches, and the bone immediately seized and extracted. * * * The result of the case was most satisfactory. The length of the forceps was seven inches. (pp. 415, 16.) The second operation was performed also successfully by Dickin, of Middleton, near Manchester, in 1832 (*c*), on a boy of eight years, who having "found a bell button, which he placed in his mouth, and during the act of jumping, it passed backwards into the windpipe. He instantly fell down, to all appearance in a state of suffocation, and was taken home, a few yards distant, making the most violent efforts to respire; after which his breathing became easy, but with

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(*a*) Liston's Practical Surgery. Fourth Edition, 1846.

(*b*) Duncan; in Lancet, 1833, 34, vol. ii. p. 419. —Also Liston's own notice of it, in his Practical Surgery; from which I have quoted.

(*c*) Liston; just cited.

repeated dispositions to cough, which alarmed him, threatening instant suffocation. * * * He complained of a sense of constriction across the chest, * * * had fits of coughing, which came on at intervals of two or three hours, during which he was comparatively easy. The face presented a purplish hue, with great anxiety depicted." Three days after, on examining the chest, its "appearance was most remarkable. On the right side a loss of symmetry, with evident depression and altered action in breathing. The stethescope indicated no respiratory murmur; whilst on the left side there was the plump symmetrical beauty of a youthful chest, with the common action of that side in respiration. * * * On the sixth day the cough ceased, and also the fits of suffocation, which evidently indicated a fixed position of the foreign body." On the tenth day it was determined to perform laryngotomy between the cricoid and thyroid cartilages; which done, a pair of forceps invented for the purpose were introduced, and "acted as a sound, for on their introduction DICKIN detected the presence of a metallic body. They were introduced again without the slightest inconvenience to the patient (at least apparently so,) when again the point came in contact with the button, which was laid hold of, and removed in their grasp. * * * For several days a considerable quantity of muco-purulent matter was discharged through the wound, having accumulated around the button in the *bronchus*." (pp. 419, 20.) In a fortnight the boy was well, and returned to school.

If after opening the *larynx* or windpipe, the foreign body be jerked up into the wound, or shot through it, immediately after the free admission of the air, the windpipe be examined by passing a straight sound through it towards the chest, and no obstruction be found it will be right to examine the *larynx* itself, and the *rima* by passing a sound upwards into the throat. The necessity for doing this is seen from the case related by PELLETAN (*a*), in which a person suffered severely from having a portion of tendon of veal lodged in his throat; it was so large that it was presumed to have lodged in the *œsophagus*; no relief, however, was obtained by the introduction of instruments, and PELLETAN therefore opened the *larynx* by division of the thyroid cartilage, and on introducing his finger, unawares thrust the tendon upwards, after which with the probang it was forced down the throat, and the patient recovered.—J. F. S.]

1763. If bronchotomy be considered in reference to the three parts at which it may be performed, namely, on the thyroid cartilage, on the crico-thyroid ligament, and in the windpipe, the following circumstances must be borne in mind with reference to the special object of the operation.

In cutting through the thyroid cartilage, it may be feared, in addition to the possibility of it being ossified, and therefore difficult or incapable of being cut through, that the laryngeal ligaments may be wounded, and that in those cases in which the operation is undertaken, on account of a swollen and thickened condition of the inner membrane of the *larynx*, the air may not obtain a sufficient entrance; the voice also may remain for a long while, or even permanently hoarse, if the operation be undertaken in the *larynx*. (PELLETAN.)

Tracheotomy, to wit, the cutting into the windpipe from the cricoid cartilage to the upper edge of the breast-bone, is always dangerous; the cut always interferes with the anastomoses of the thyroideal arteries; if the arterial *plexus* of the thyroid gland be wounded, it is very difficult to stanch the bleeding, and the blood flowing into the windpipe causes violent cough. In thick-necked persons the operation may be extremely difficult, and even impossible. In children it is always very difficult, on account of the thickness of their neck and the depth of their windpipe (1). If there be an *arteria thyroidea ima*, it will certainly be wounded.

Opening the crico-thyroid ligament, and enlarging the wound downwards through the cricoid cartilage, and the first two or three rings of the windpipe *(Laryngo-tracheotomia)* seems therefore to be the most advantageous proceeding, both where it is desired to assist the entrance of the air, and to remove a foreign body, because by this method the arterial

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(*a*) Clinique Chirurgicale, vol. i. p. 13.

plexus and the deep position of the windpipe are best avoided. Even if the foreign body be lower down in the windpipe, it may be either brought near the opening, by breathing or coughing, or it may be with proper care taken out with a blunt curved director or with the forceps. If it be found fixed in the *larynx*, the cut may even be extended from the crico-thyroid ligament along the middle of the thyroid cartilage. By this mode of proceeding, then, the object of the operation is best attained in all the conditions of the disease which have been mentioned (*par.* 1756); and a deeper cut into the windpipe would be required only in those cases where the situation of a foreign body in the *œsophagus*, or other tumours, which compress the windpipe may render it necessary.

(1) According to ALLAN BURNS (*a*), the position of the thyroid gland should be determined by the cricoid cartilage, and in children the space between this gland and the upper part of the breast-bone is great, therefore tracheotomy is easier.

1764. The varieties observed by ALLAN BURNS in the vessels of the neck always renders careful observation necessary during the course of the operation. He found the *arteria innominata* near the under edge of the thyroid cartilage, and even the carotid itself crossing the windpipe.

SECOND SECTION.—OF UNNATURAL COLLECTIONS OF NATURAL PRODUCTS.

A.—IN THEIR PROPER CAVITIES AND RECEPTACLES.

I.—OF RANULA.

LOUIS, Sur les Tumeurs Salivaires; in Mém. de l'Acad. de Chir., vol. iii. p. 462.

IBID., Sur les Tumeurs Sublinguales; in same, vol. v. p. 420.

MURRAY, De tumoribus salivalibus. Upsal, 1785.

BRESCHET, Considérations sur la tumeur nommée Ranula ou Grenouillette; in Journal Univers. des Sc. Medic., 1817, vol. vii. p. 296.

REISINGER, Bemerkungen über die Froschgeschwulst; in his Baier'schen Annalen, vol. i. p. 1618.

KELL, Beobachtungen über Froschgeschwülste; in VON GRAEFE und VON WALTHER'S Journal, vol. xxvi. p. 588.

1765. *Ranula* (*Ranula*, Lat.; *Froschgeschwülste*, Germ.; *Grenouillette*, Fr.) is a tumour beneath the tongue, sometimes soft and fluctuating, sometimes hard and firm, at first attended with little inconvenience, but in proportion as it enlarges, it interferes with chewing, and especially with speech. Should the swelling attain a very considerable size, it occupies the greater part of the mouth, thrusts the tongue upwards and backwards, occasionally also the front teeth outwards, and at the same time forms a swelling beneath the jaw. In this state the symptoms just described are very marked, the swelling itself becomes painful, and may inflame and suppurate. *Ranula* is sometimes developed not towards the mouth, but downwards, forming beneath the jaw and on the front and sides of the neck a very considerable swelling, which may be easily mistaken for an abscess.

[The elder CLINE used to mention in his Lectures that he was one morning alarmed by the noise of a person breathing with great difficulty in the next room to his consulting room, and on hastening in he found the man stretched on a chair, and almost suffocated. On being inquired of as to what was the matter, he pointed to his mouth; upon

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(*a*) Surgical Anatomy of the Head and Neck, p. 415.

looking into which, CLINE observed a large *ranula* thrusting back the tongue, which he instantly punctured with a lancet, and relieved the patient from the threatening suffocation.—J. F. S.]

1766. Passing over PARÉ's opinion of the nature of *ranula*, that it consisted of a cold, moist, clammy, matter, which proceeded from the brain to the tongue, two different views have been taken of it. *First*, It has been considered as an encysted swelling by FABR. AB AQUAPENDENTE, DIONIS, HEISTER, MECKEL, in part, VON WINTER, SYME, and others. *Secondly*, As a stoppage or closure of the Whartonian duct, from which results the retention of the spittle of the submaxillary gland and the distension of the walls of the duct in consequence of the spittle collected in it; an opinion first started by MUNICHS (*a*), afterwards more especially declared by LOUIS, and up to the present time held by most writers. This opinion rests specially upon the state of the fluid contained in the swelling, which, similar to white of egg in colour and consistence, by long continuance in the swelling, becomes viscid, dusky, and frequently mixed with stony concretions (1); and upon the possibility, in many instances, by opening the obstructed Whartonian duct with a probe, to discharge the fluid and effect the cure. REISINGER, who frequently found, by examination with a delicate probe, that the Whartonian duct was still pervious, supposes, on the contrary, that the thickening of the spittle was not merely the consequence of it being retained, and that this was always in proportion to the time the swelling had existed, but that unnaturally secreted spittle perhaps accompanied with atony of the duct, caused the development of *ranula*, and that it was not merely formed by the distended Whartonian duct, but that not unfrequently the distended Whartonian duct burst, and the secreted fluid poured out, and was contained in a sac of cellular tissue, not unlike a cystic tumour; in which way the various forms of *ranula*, as well as the often occurring transparency of the Whartonian duct could be accounted for. This opinion has also been more recently put forth by HENNEMANN (*b*). KYLL endeavoured to deny that *ranula* depends on distension of the duct; inasmuch as it is imposible, that so small and thin a duct could bear so great distension as is observed in large swellings of this kind; that the fluid contained is not at all similar to spittle, but of the consistence of fat oil, brownish, like yellow olive oil, clammy, clear, and transparent; and according to the statement of the patient after the operation, tasteless, and that these conditions are really from the first, and not as LOUIS supposes, similar to white of egg. When swelling has existed a longer time the submaxillary glands swell, inflame, the and harden, by which their functions are destroyed. *Lastly*, If the spittle continue to flow, as after DUPUYTREN's mode of operating, the disease diminishes, at least it never increases, which, however, is not always the case. Upon these grounds, KYLL holds to the old opinion; according to him, the swelling has a sac which is probably an hydatid.

[(1) The elder CLINE himself had a stony concretion in one of the submaxillary ducts, which was readily removed by a slight cut through the membranes covering it. I am not aware, however, that it was accompanied with any degree of *ranula*.—J. F. S.]

1767. As unfortunately up to the present time pathologico-anatomical observations upon the seat of *ranula* are entirely wanting, it is impossible to give a very decided judgment upon these different opinions, and still

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(*a*) Praktyke der Heilkunde, p. 141.

(*b*) Beiträge Meklenburg. Aerzte zur Med. und Chirurg., vol. i.

more as several swellings beneath the tongue are known, to which the term *ranula* has been applied, which have nothing in common with it but their seat beneath the tongue. In the entire absence of anatomical observations on the nature of this disease, chemical examination of the fluid can alone be useful in more satisfactorily deciding whether it be spittle or not. I have found this fluid, both in recent and long-continued *ranula*, pale yellow, or brownish yellow, clear, thickly fluid, like white of egg, very fibrous, so that it could not be poured in drops, but hangs together like *mucus*. Its chemical examination showed no resemblance to spittle; it consisted principally of albumen. If, therefore, it be not admitted that the fluid which the submaxillary and sublingual glands secrete, differ from the spittle of the parotid gland in its composition; or if, when *ranula* exists, there be not an accompanying qualitative change in the secretion of these glands, then manifestly *ranula* must be considered as the collection of a peculiar fluid external to the Whartonian duct, beneath the mucous membrane of the mouth, or in a proper sac (mucous bag) which latter opinion I consider most likely, and therefore *ranula* must be ranked with dropsy of mucous bags.

According to the chemical examination of the fluid from a *ranula* of a boy of twelve years old, which my respected friend and colleague L. GMELIN has published, it consists of water 94·6, of soluble albumen with a very small quantity of stearine, osmazome, salivary matter (?), and carbonate, nitrate and acetate of potash, 5·4, in 100 parts. Hence the fluid has no resemblance to spittle, as it wants the sulpho-cyanite of potash, and almost the entire salivary matter; on the other hand, it contains a large proportion of albumen, which does not exist in healthy spittle. Opposed to this is the examination by DR. L. POSSELT, of a stone weighing 0·623 of a grain, which I removed from the Whartonian duct, from which it appears that in 100 parts were contained 7·8 of matter soluble in water, which showed the reaction of salivary matter; 13·3 of matter insoluble in water (salivary mucus); 68·87 of phosphate of lime, and 9·93 of carbonate of lime. POGGIALE found a stone from the Whartonian duct to consist of 94$\frac{6}{8}$ of neutral carbonate of lime, 4 per cent. of animal matter, and 2 per cent. of water.

According to FLEISCHMANN, there are a pair of mucous bags beneath the tongue, upon the *m. geneo-glossi*, where they enter the tongue, a little distant from its front edge, in the *frænulum linguæ*, and behind the opening of BARTHOLIN's duct. They are some lines in length, very distinct, and of unequal size on the two sides, the right being generally larger than the left. In one instance it was divided on the right side by a partition into two parts.

When a salivary stone forms in WHARTON's duct, inflammation and suppuration must arise in its gradual enlargement, by which the stone will be spontaneously thrown out, as I have twice seen; but never, even when the duct is completely closed by the stone, is there any condition similar to *ranula*. There is inflammation and swelling of the glands, which if the abscess be discharged by bursting or cutting soon subsides, only a hardness in the surrounding cellular tissue remains for some time.

1768. According to the difference of opinion as the nature of *ranula* is the ætiology different. An altered condition of the spittle has been assumed by which it is disposed to the deposition of stony concretions, or simple thickening of the spittle, and thereby stoppage of the Whartonian duct is set up, or union of the duct by inflammation and the like. In no case have I been able to ascertain any decided causal condition. *Ranula* is not unfrequently observed in newly-born children, and occurs more frequently in early than in later years.

1769. The *treatment* of *ranula* consists either in opening the swelling and discharging its fluid, with which also it must be sought to prevent the complete closure of this opening, so that the ever-collecting fluid may have a continual escape; or in putting a stop to the secretion by exciting a sufficiently smart inflammation, by destruction of the swelling with caustic, or by its removal with the knife. With these several objects various modes of treatment have been proposed. *First.* Opening the swelling with the actual cautery, (Paré,) or with caustic, in persons who fear the knife with butyr of antimony (Zang.) *Second.* Puncture or cutting through its whole length (Louis.) *Third.* Cutting into the swelling and filling it with caustic and irritating materials, honey of roses with sulphuric acid, (Heister, Dionis,) lunar caustic, (Camper,) muriatic acid, (Acrel,) stuffing with lint (Callisen, Schreger.) *Fourth.* Partially cutting away the external wall, (Boyer,) with cauterization of the hinder wall, (Sabatier, Vogel, Wilmer, Chopart, Desault, and others.) *Fifth.* Introduction of a seton (van der Haar and others,) *Sixth.* Introduction of a leaden thread, or of a bundle of lint (Louis, Sabatier.) *Seventh.* Extirpation of the whole sac (Marchetti, Richter, and others.) *Eighth.* Opening the swelling and in healing a little cylinder of two flat small silver, gold, or platina plates, or a similar instrument of elastic gum. (Henning.)

Richter (*a*) recommends, in the *ranula* of children, cauterization with lunar caustic. After a clean good wound has been produced by the first touching the whole surface, the caustic is to be repeated as often as the wound diminishes. This is never required more than ten times.

When the *ranula* is not large and old, and its membranes are thin, the opening of the salivary duct sometimes appears like an aphthous spot, and is only closed with viscid matter or with a stony concretion; in such cases the duct should, according to Louis, Chopart, and Desault (*b*), be again rendered pervious by introducing a probe, and endeavouring to discharge the collected fluid, with which object the passage of the canal must be endeavoured to be kept open, by introducing a leaden thread, which must from time to time be withdrawn to allow the escape of the spittle. All writers agree that this treatment is rarely suitable in its operation, as has been already observed in speaking of the nature of *ranula*, and as in many cases the salivary duct is found pervious, it is highly probable that a change in the condition of the swelling will take place without it.

1770. Of the several modes of treatment, that proposed by Dupuytren is the most simple and certain. A small cut, or a puncture with a lancet is made in the swelling, and after the fluid has been emptied, a silver, gold, or, best of all, a platina cylinder, three inches long, an inch and a half thick, composed of two little elliptical plates, externally convex, and internally somewhat concave, and then the edges may be fixed about the cylinder. My own practice confirms this mode of treatment; I have in every case succeeded in effecting a permanent cure; the inner cylinder produced no inconvenience; and when after some time it was displaced and thrown out, the edge of the inner plate having produced union, and there was no return of the disease. Others have not had success by this method (von Graefe, Kyll.) And if the swelling should afterwards return, the removal of its front wall is most efficient, for which purpose it must be lifted up with forceps, and cut off with Cooper's scissors (*c*).

Reisinger's modification of Dupuytren's cylinder, which he provides with an aperture to allow the constant escape of the fluid, I have found without objection.

[On the whole, I think the best method of treating *ranula* is by hooking up with a tenaculum a portion of its wall, and cutting it out with a pair of scissors; which done, the edge of the wound should be found and freely cauterized with lunar caustic. But it is often necessary to repeat this operation two or three times before a permanent opening can be established. I have, in a few instances, passed a needle and thread through, and including a quarter of an inch of the wall of the swelling in the thread, tied and allowed it to ulcerate out. The success of this mode of treatment is, however, less than that of the former.—J. F. S.]

(*a*) Medicinische Vereinszeitung, 1838, No. 23.

(*b*) Œuvres Chirurg., vol. ii. p. 217.

(*c*) Breschet; above cited.—Schartler; in oesterr. Med. Jahrbüchern, vol. xvii. pt. iv.

II.—OF RETENTION OF BILE.

Petit, Remarques sur les Tumeurs formées par la bile retenue dans la vésicule du fiel et qu'on a souvent prises pour des abcès au foie; in Mém. de l'Acad de Chirurgie, vol. i. p. 155.

Morand, Observations sur les Tumeurs à la vésicule du fiel; in same, vol. iii.

Bloch, Medicinische Bemerkungen. Berlin, 1774 iv.

Sebastian, A. A., Dissert. de Hydrope vesiculæ fellis. Heidelb., 1827.

1771. The already mentioned (*par.* 912) overfilling and distension of the gall bladder when the outflow of the bile by the *ductus choledochus* is prevented, always occurs gradually. The patient, having previously lost his appetite, feels, for a longer or shorter time, a dull pain under the ribs on the right side, which often extends to the region of the stomach and loins. Afterwards there frequently occur, with previously lost appetite, disturbed digestion, costiveness, pain in the right hypochondrion, and more or less severe jaundice, symptoms of colic, the seat of which is, especially opposite the points of the ninth rib, accompanied with frequent vomiting, febrile and other symptoms. If, under these circumstances, the painful part of the right hypochondrion be examined, a more or less distinct round swelling is observed, projecting a little below the front edge of the liver, confused with it above, and more or less easily felt in different positions of the body. The swelling, sometimes of itself, at other times at the very moment when pressed, diminishes and is less tense, whereupon all the symptoms diminish and bilious stools follow. If the distension of the bladder be considerable, and have existed long, the swelling loses its mobility, becomes united to the *peritonæum*, and appears equally attached to the wall of the belly and to the liver.

[In the Museum at St. Thomas's is a gall bladder equal in size to the urinary bladder of an ox, which was taken from a female patient who had been under the care of Cheston of Gloucester. She had had a projection at the pit of the stomach for a few years, which, as it increased, caused her much pain, and was presumed to be an abscess of the liver. It was punctured and a considerable quantity of bile flowed out. The wound was closed, but she died a few days after (*a*).—J. F. S.]

1772. It appears that in this disease the flow of bile into the intestinal canal is most commonly not entirely prevented, and the patient has daily natural coloured motions. The disease may terminate in biliary fistula, in which case the gall bladder having adhered to the *peritonæum*, the bile collected in it makes its way out externally. The gall bladder may also grow to the *colon* or to any other intestine, and empty itself into it; or no union with the *peritonæum* having taken place, it may burst, and a fatal effusion of bile into the cavity of the belly may ensue.

[Sometimes when the *ductus choledochus* is obstructed, the gall bladder becomes adherent to the *duodenum*, ulceration takes place, and by this new opening the bile is, and continues to be discharged, and the functions of the gall bladder ceasing, it diminishes to the size of an acorn, as in a preparation in St. Thomas's Museum.—J. F. S.]

1773. As to the *treatment* of this disease, at first it is merely confined to the use of those remedies which soothe or remove the irritable or inflammatory condition. At the same time it must be attempted, by rubbing, stroking, and pressing the swelling, to empty part of its contents into the *duodenum*, and to apply discutient remedies. As long as it is uncertain that there is considerable union of the gall bladder with the *peritonæum* (which may indeed be presumed, although it cannot be asserted

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(*a*) MS. Lectures.

with perfect surety, if the patient have had frequent symptoms of inflammation and the swelling is no longer movable, as also by a slight adhesion the latter may be effected) we must not dare to undertake the evacuation by opening the gall bladder, as fatal escape of the bile is to be dreaded. For this reason it appears not advisable to open the swelling previous to the inflammation of the wall of the belly, and even of the external coverings being distinctly ascertained, that the bile may make its way out externally, in which case the adhesion is always to a proper extent (*a*).

1774. Opening the gall bladder is best managed by making a cut into the skin an inch and a half long upon the swelling, and then smaller cuts through the muscles down to the *peritonæum*; then with the forefinger of the left hand it must be cautiously ascertained if the gall bladder adhere, and at the most fluctuating part the bistoury or lancet should be thrust through the *peritonæum* and the wall of the gall bladder. If the adhesion between the gall bladder and *peritonæum* be not fully made out, then, after the *peritonæum* has been laid bare as just mentioned, a trocar is to be thrust into the most fluctuating part and the tube left in till the gall bladder and *peritonæum* have united together, or caustic should be applied to the *peritonæum* to produce this union (*b*).

1775. When the gall bladder has been emptied the opening must be gently filled with lint, the inflammatory symptoms excited must be treated with proper remedies, and in other respects it must be treated as has been already mentioned in biliary fistula (*par.* 913.)

III.—OF RETENTION OF URINE.

Albrecht, G., De Ischuriâ. Götting., 1767. 4to.

Wagner, J., Dissert. de Ischuriâ vesicali atque vesicæ paracentesi. Argent, 1779. 4to.

Murray, Dissert. de Paracentesi Cystidis urinariæ. Upsal, 1771. 4to.

Weldon, Walter, Observations on the different modes of Puncturing the Bladder in cases of Retention of Urine; with an Appendix on Retention of Urine, and on Catheters. Southampton, 1783. 8vo.

Bonn, A., Bemerkungen über die Harnverhaltung und den Blasenstich über dem Schaambein. From the Dutch. Leipzig, 1796. 8vo.

Schmid, W., Ueber diejenigen Krankheiten der Harnblase, Vorsteherdrüse, und Harnröhre (mit Ausnahme der Blasensteine) denen vorzüglich Männer in hohem Alter ausgesetzt sind. Wien, 1806. 8vo.

Desault, Œuvres Chirurgicales, vol. iii. p. 112.

Soemmering, S. T., Abhandlung über die schnell und langsam tödtenden Krankheiten der Harnblase und Harnrhöre bei Männern im hohen Alter. Frankf., 1822. 8vo. Second Edition.

Chopart, Traité des Maladies des Voies urinaires. Nouvelle Edition, par E. H. Felix Pascal. Paris, 1821. 2 vols. 8vo.

Heinlein, Bemerkungen über die Ischurie; in Harless Jahrbüchern der deutschen Medicin und Chirurgie. vol. i. p. 185; vol. iii. p. 102.

Bell, Charles, A Treatise on the Diseases of the Urethra, Vesica Urinaria, &c. Third Edition; with Notes by J. Shaw. London, 1822. 8vo.

Bingham, Robert, A Practical Essay on the Diseases and Injuries of the Bladder. London, 1822. 8vo.

Howship, James, On the Diseases of the Urine and the Urinary Organs. London, 1823. 8vo.

Moulin, Nouv. Traitement des Rétentions d'Urine. Paris, 1824.

1776. *Retention of Urine* (*Retentio Urinæ*, *Ischuria*, Lat.; *Urinver-*

(*a*) Delpech; Précis Elémentaire, vol. ii. p. 272.

(*b*) Richter; Anfangsgründe, vol. v. p. 125-27.

haltung, Germ.; *Retention d'Urine*, Fr.) designates those diseased conditions in which the urine is retained by any obstacle in the canals destined for its discharge. This obstruction may be in the kidneys, in the bladder, or in the *urethra*, and hence is named either *Ischuria renalis*, *ureterica*, *vesicalis*, *urethralis*. The discharge of the urine is thereby either completely stopped, or it may be voided with difficulty (*Dysuria*) or only by drops (*Stranguria.*)

Retention of urine from growing together of the lips of the *urethra* has been already treated of (*par.* 1702.)

That state of disease in which, on account of local disturbance in the kidneys or by a general disease, *no urine is secreted*, (*Anuria, Suppressio Urinæ*,) must be distinguished from retention of urine (*a*).

1777. Retention of urine in the urinary passages and in the kidneys may be produced by foreign bodies which fill their cavities, as stones, hydatids, lumps of blood, pus, thick mucus, worms, or by inflammation, chronic swelling, and spasm of these passages, or by swellings which compress the bladder. The obstruction which prevents the passage of the urine through the ureters is rarely on both sides, therefore complete retention of urine is rare; the flow of urine may be completely or incompletely prevented.

1778. All the symptoms which manifest *retention of urine in the ureters* are doubtful. The patient feels more or less violent urging, stabbing pain, extending from the region of the kidney downwards, and increased on motion. Although there may be a smaller discharge of urine, yet are the signs deficient which show a collection of urine in the bladder. But if the patient have previously voided some little stones with the urine, if with previous pain in the kidneys a stabbing pain seem to strike downwards, and there be a sense of weight and tension at one particular spot, it may be presumed, with probability, that the ureter is stopped by a stone. The distension of the ureter above the obstruction becomes gradually greater, though externally no swelling be observed, which, however, is contradicted by ALLAN's (*b*) case (1).

At last the urine collects in such quantity that the ureter increases to double and triple its size. If the stoppage be only at one part, the ailment may continue longer without particular inconvenience; under which circumstances, by the vicarious activity of the other kidney, the ordinary quantity of urine is passed. The dangers which may be specially produced by *Ischuria ureterica*, are complete suppression of the urinary secretion, by which the following general symptoms may be caused: inflammation, suppression, and bursting of the ureters and kidneys; in which case extravasation of urine into the cellular tissue and urinary *fistulæ* follow, or if the urine be poured into the cavity of the belly, fatal inflammation.

(1) The patient suffered early from gravel, and treatment was employed proper for symptoms of stoppage of the ureter by stone, which passed off in four days. A swelling then arose on the left hip, which daily increased, whilst the quantity of urine daily diminished. Three weeks from the commencement of the disease the skin and muscles were cut through above the crest of the hip-bone, and the transversal *fascia* pierced with a trocar, which was thrust into the cavity beneath, from which seven pints of urine escaped. The symptoms diminished; no tube was left in; the symptoms of irritation returned, and after a week, a tube having been again introduced, six pints of urine and two of pus were evacuated. The disease subsided, and recurred from time to

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(*a*) ABERCROMBIE, J.; in Edinb. Med. and Surg. Journ., vol. xvii. p. 210. 1821.

time. The patient died five months and eleven days after the operation, during which time the urinary fistula remained. Death was caused by gradual wasting. On dissection, the kidney was found expanded into a cellular sac, the mucous membrane of the ureter thickened, and completely closed below with coagulable lymph (*b*).

1779. The *treatment* of *Ischuria ureterica*, when accompanied with violent pain and inflammatory symptoms, consists only in the employment of antiphlogistic remedies, blood-letting, soothing clysters, bathing, stoups, and the like. In the contrary condition, shaking motions, as riding, and even vomiting may be successfully employed, in order to favour the descent of the stone in the ureter.

1780. When the *urine is retained in the bladder*, various symptoms occur according to the degree and duration of the collection. The patient feels a constant urging to void his urine, but is unable to do so; there is weight and tension at the lower part of the belly, and in the *perinæum*; a swelling rises above the *pubes*, elastic and at times fluctuating, ascends oftentimes up to the navel, and even still higher, generally in the middle of the belly, but sometimes more to one side than the other. As the bladder enlarges, especially from above downwards, so it thrusts down its base, forcing it against the *perinæum*, presses upon the *vagina* and in men upon the *rectum*, where on examination with the finger introduced into the gut, it is felt as a compressible elastic swelling. Sometimes the bladder is but little distended, on account of the peculiar rigidity of its coats. In fat persons the swelling is not so distinctly felt as in thin ones.

An important symptom which is rarely wanting, and which may be perceived even in very stout persons, is the dull sound perceived on percussion from the sword-like cartilage down along the white line, and from the iliac spine of one side to that of the other, in the region of the bladder, by which, as well as by the shriller abdominal sound in the neighbourhood of the bladder, the extent of that organ can be ascertained. Another important pathological sign is the fluctuation of the fluid in the bladder, which is perceived when, with one finger in the *rectum* or *vagina*, and the other hand placed over the region of the bladder, it can be produced and felt by the alternate pressure of one or other (Pigné.)

1781. If the urine be not passed in the usual way, the distension of the bladder becomes greater, and the result of the disease varies. The bladder may burst by partial gangrenous destruction (1), and the urine be poured forth into the neighbouring cellular tissue, in which case either urinary *fistulæ* are formed, or death ensues as the consequence of gangrenous inflammation of the bowels. The bladder may be violently inflamed, and the inflammation spread over the abdominal intestines. Sometimes, when the bladder has attained its greatest distension, the ureters are also considerably distended up to the kidneys, which on account of the oblique entrance of those canals into the bladder, has been doubted by some persons. From the decomposition of the urine, and its reaction upon the whole organism, severe fever arises, with speedy sinking of the powers, extremely quick pulse, dry tongue, *coma* and *delirium*; the perspiration of the whole body has an urinous smell; all the excretions are altered; often there is watery vomiting with an urinous smell, and the patient soon dies. Sometimes the *urachus* opens, and the urine flows out through the navel (2).

[(1) Bursting of the bladder from retention of urine either without or with gangrene is of very rare occurrence; I have never seen nor had personal knowledge of such a

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(*b*) London Medical Gazette, vol. xix. p 888. 1837.

case. Nor, as far as I am aware, is gangrene even of the bladder often met with. CHESTON indeed mentions (*a*) an instance, which however I think seems very doubtful. A woman thirty-five years of age, and four months gone with child, had suppression of urine, for which a catheter was passed, and five pints of water drawn off. Seven or eight days after she again had retention, but then only half a pint of water could be withdrawn by the instrument; after this, however, water continued to pass. On the fourteenth or fifteenth day from the first attack she died, the bladder having risen up to the navel. On examination, it was found to contain a quart of fœtid, thick, purulent urine, and the *fundus* of the bladder is stated to have been completely sphacelated. The walls of the bladder had doubled by the pressure of the womb, so as to form two cavities, and this fold had prevented the entrance of the catheter.

(2) The opening of the *urachus*, I think, must be admitted with very considerable doubt. I have on one occasion, however, seen in a healthy woman a very small oozing of clear fluid entirely free from smell or acridity from the navel, which I thought might have been from the *urachus*. It had existed for a considerable time. Astringents were used for some time without advantage, and she ceased coming to me.—J. F. S.]

1782. If a retention of urine have been slowly produced, so that for a long time previous, only part of the urine has been voided, whilst the bladder itself still remained full, the symptoms are less active. From the urine collected in the bladder, which becomes decomposed, a slow inflammation is produced, which specially attacks the mucous membrane, and alters its secretion. The general health is disturbed, the digestion suffers, the countenance pales, the muscles become flabby, the patient suffers from fever, and the like. The walls of the bladder often become much thickened, and frequently folds, and all the deepenings are produced by the separation of the muscular fibres (1).

(1) These sac-like deepenings are the first step of the spontaneous perforation of the bladder, which MERCIER (*b*) has well described, and which has been considered to be caused by the use of the sound. The mucous membrane of the bladder pushes into these deepenings, and is sometimes in immediate contact with the *peritonæum*; sometimes separated from it by a peculiar thick layer of cellular tissue. These deepenings occur specially on the sides, and on the under part of the hind wall of the bladder, above the openings of the ureters. After a certain time the mucous membrane often ulcerates at the bottom of these sacs, and is followed by a pouring forth of the urine; the mucous membrane may even be torn in retention of urine, and in the violent efforts to discharge it, which cause these cell-like deepenings, after or even without previous ulcerative inflammation (2). As the bottom of these sacs have not contractility, which their opening, surrounded by muscular fibres, have, the urine contained in them, is with difficulty renewed; it collects, decomposes, and produces inflammation. Sometimes stones form in them, which gradually enlarge, and distend the bottom of the sac, without enlarging its opening, and thus encysted stones are formed, which may also excite inflammation, and cause perforation. The suppuration which results from such perforation, may spread into the cellular tissue beneath the *peritonæum*, and there form one or more abscesses, which open into the *peritonæum*, either without previous adhesion, in consequence of which death speedily follows; or after the suppuration has been bounded by adhesion, in which case fatal symptoms less frequently follow. Sometimes the abscess opens into an intestine, sometimes in the wall of the belly, into the flank, and so on, and cause death only consecutively. Under these circumstances also urinary *fistulæ* may be formed (PIGNÉ.)

[(2) The bursting of these deepenings or sacs is certainly very rare.—J. F. S.]

1783. The causes of retention of urine in the bladder may be, *first*, palsy of the bladder; *secondly*, inflammation; *thirdly*, spasm; and *fourthly*, stoppage of the urine depending on foreign bodies introduced into the *urethra* or bladder, or on stones, coagulated blood, and so on, on swelling and hardening of the prostate gland, on growths in the bladder, on

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(*a*) Pathological Inquiries and Observations in Surgery. Gloucester, 1766. 4to.

(*b*) Gazette Médicale, vol. iii. p 312, 1835.

pressure of the impregnated or unimpregnated womb, on swellings or hardened intestines, or on strictures.

1784. *Paralytic Retention of Urine* (*Ischuria paralytica*) in general comes on slowly, the urine is no longer discharged with the usual power, the patient soon feels the need of voiding it again, which he can only effect with the greatest exertion. This difficulty gradually increases, the urine at last flows off involuntarily, and the patient can by his efforts but little or not at all increase the flow, which at last stops completely. The distended bladder forms the already mentioned (*par.* 1780) swelling above the *pubes*, which is nearly painless, and sometimes in such degree that it may be mistaken for pregnancy or dropsy, which may be the more possible as the patient occasionally retains the power of voiding his urine by violent efforts, often even in a quantity equal to the drink taken in the day, without, however, emptying the distended bladder. If the filled bladder be somewhat firmly pressed, a few drops of urine will escape through the *urethra*.

Sometimes paralytic retention arises quickly under severe symptoms of a spasmodic and inflammatory affection of the neck of the bladder, when, if speedy assistance be not afforded, considerable distension of the bladder, and palsy of its walls are produced. In the later course of the disease, there are accompanying it a flow of *mucus* from the bladder, thickening of its walls, swelling of the prostate gland, and the like. This kind of paralytic retention of urine happens most commonly in old persons who have been dissolute in various ways, have suffered from gout and rheumatism; and usually the gout or rheumatism is the proximate cause.

1785. When the bladder in this retention of urine has become very much distended, the pressure of the abdominal muscles and bowels prevents its further distension; some urine always dribbles, and bursting of the bladder does not take place. But inflammatory symptoms, and more or less severe fever may accompany it. The flow of urine is then completely stopped, and the bladder may be distended to such extent that it may become grangenous and tear; this, however, is a rare termination.

OESTERLEN (*a*) divides paralytic retention into *Ischuria paralytica partialis vesicæ*, in which the powers of the bladder and abdominal muscles are very weak; and *Ischuria parylytica universæ vesicæ*, in which there is accompanying palsy of the bladder, and the *sphincter* muscle of that organ.

1786. This form of retention of urine is peculiar to old people, and depends on the loss of contractile power in the bladder, and on the generally diminishing muscular activity in advanced age. It may be the result of previous debilitating causes, debauched life, venereal disease, frequent onanism. The bad habit of holding their water very long frequently produces it in persons who lead a sedentary life, who work hard and frequently allow the disposition to make water to pass by without attending to it. It may also result from concussion and palsy of the lower part of the spinal marrow and sacral nerves, or from organic disease of the spinal marow: it frequently occurs in nervous fevers.

1787. The *prognosis* of this disease is guided by its degree and duration, by the age of the patient and by its cause. It is most easily cured in young people; the older the patient and his disease are, the less hope is there of cure. If the disease be caused by affections of the spinal marrow and sacral nerves, the *prognosis* must be directed by them.

(*a*) Heidelb. klinisch. Annalen, vol. viii. p. 421.

1788. The *treatment* of paralytic retention consists in emptying the bladder of its urine, and in restoring its contractile power. The remedies which answer to the latter indication are useless without attention to the former.

1789. Emptying the bladder by means of the catheter, must be performed so frequently, that all distension from the collecting of the urine must be prevented. The catheter may be either introduced afresh as often as necessary, or an elastic catheter may be left in, which in all cases where the patient is not under immediate observation, is the most fitting, as the urine often collects again with great quickness, and therefore the bladder again becomes greatly distended. The introduction of the catheter is in these cases always unattended with difficulty, and generally in a short time the patient may learn himself to pass it. If the bladder be weak, the urine sometimes only flows through the catheter, when pressure is made on the belly. This indisposition of the urine to pass by the catheter, may lead to the mistake that the instrument is not in the bladder (*a*). The catheter must be continued till the urine pass through it, and between it and the *urethra*, in a strong unbroken stream; and if even the patient should void his urine without the catheter, it should be frequently ascertained by introducing it, that no urine be retained in the bladder.

1790. The remedies which answer the second indication are, cold bathing of the pubic region and *perinæum;* cold applications, cold injections into the *rectum;* rubbing volatile salves on the *perinæum*, and on the region of the bladder. Internally should be given *arnica*, *oleum animale Dippelii*, *cantharides* to the amount of a grain daily with camphor and gum-arabic, tincture of *cantharides* up to fifteen or twenty drops, with almond milk. And in addition to these general strengthening baths, galvanism, electricity, and blisters upon the *sacrum*. When the patient can again himself discharge his urine, he must not dare to allow the least disposition to void it to pass unsatisfied.

1791. In the quickly occurring paralytic retention, where gout or rheumatism are in play, warm sulphur baths, fomentations of aromatic herbs with wine and vinegar, rubbing in oil of juniper, particularly on the inside of the thighs; cupping and easily digestible diet are to be used. If violent inflammatory symptoms be present, leeches are to be applied to the *perinæum*. The introduction of the catheter, necessary as it be, is generally difficult on account of the contraction of the neck of the bladder.

1792. If paralytic retention have existed for some time, and be accompanied with an inflammatory condition, it must, according to circumstances, be treated antiphlogistically with blood-letting, clysters, diluting, slightly astringent drinks, as alum milk, and the like. If the disease be incurable, as frequently it is in very old persons, and if it have long existed, the patient should always use a catheter for emptying his bladder.

A somewhat contrary condition to that of palsy of the bladder is that in which, consequent on some irritation, or bad habit, the urine is voided too quickly, and thus the capacity of the bladder gradually so diminished, that only the smallest quantity of urine can be made, and therefore painful urging on the collection of the smallest quantity of urine becomes habitual. The gradual origin of this condition may be inferred from its history, and if on examination with the catheter, no stricture in the *urethra* be found, no foreign body in the bladder, and the catheter do not pass into the cavity of the bladder.

The *treatment* of this ailment must consist in the gradual extension of the walls of

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(*a*) Oesterlen; above cited, p. 420.

the bladder to their natural condition, which must be done by voluntarily retaining the urine, or if this be impossible, by introducing a catheter morning and night for a long while, by which the intervals of relieving the bladder may be gradually lengthened (*a*). The over-sensibility of the bladder is thereby checked by compelling it to bear a greater degree of irritation, and by the same means also the contractile power of its *sphincter* may be increased. In most cases this great sensibility of the bladder is connected (when it does not depend on local disease in the urinary passages) with disturbance of the digestive organs and irregular living, and requires gently purgative and afterwards tonic remedies, lukewarm bathing or washing the *perinæum* with lukewarm water, clysters with opium, purgatives, and strictly regulated diet.

1793. *Retention of Urine, depending on inflammation, (Ischuria inflammatoria,)* commences with the most violent and dangerous symptoms. Besides great urging, the patient feels a deep-seated pain in the bladder and neighbouring parts. There is accompanying fever, the distended region of the bladder smarts when touched, and is frequently reddened. The inflammation spreads over the other bowels; eructations and vomiting occur, and if they continue beyond the sixth day, the patient's life is in extreme danger, and death is almost unavoidable. Sometimes the inflammation takes a more insidious course, and puriform secretion with thickening of the bladder occur.

1794. The inflammation in this retention may be seated in the whole canal of the *urethra*, in the neck of the bladder, in the prostate gland, and even in the bladder itself.

Its *causes* are, external violence, which attacks the *perinæum* and region of the bladder, stones in the bladder, extension of the irritation of the *rectum* in hæmorrhoidal affections to the bladder, rectal *fistulæ*, and the like; a high degree of inflammation in *gonorrhœa*, suppression of the usual discharges, suppressed gout, repressed eruptions on the skin, and catching cold.

1795. Antiphlogistic remedies must be employed in inflammatory retention of urine, with reference to the cause which has produced it. Blood must be taken away and leeches applied to the *perinæum;* mucilaginous drinks taken, though in as small quantity as possible, in order not to increase the filling of the bladder. As in inflammatory retention, spasmodic contraction of the neck of the bladder is always present, warm anodyne applications must be made to the *pubes* and *perinæum*, warm vapour of camomile to the *perinæum*, rubbing in volatile ointments, clysters with opium, and the like employed. Tobacco clysters are much relied on. Blisters must not be applied; calomel and opium internally are specially effective.

1796. In severe gonorrhæal inflammation soothing applications are also to be made over the whole *penis*, the patient laid horizontally, and the testicles supported with a suspender. In hæmorrhoidal affections leeches are applied to the *rectum*, and internally, cream of tartar and sulphur given.

1797. Although emptying of the urine be necessary, as by its irritation it causes the inflammation, it must not be used till the remedies already recommended have been employed. The introduction of the catheter is here always painful and difficult; an elastic one is best used, and its point should be passed far into the bladder, so that its walls should not be irritated. If the catheter can in no way be introduced and mortification of

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(*a*) von Winter; über die Harnbeschwerden von verminderter capacität der Harnblase; in Graefe und von Walther's Journal, vol. i. p. 309. —Hyslop; in Med.-Chir. Trans., vol. vi. p. 108. —Bingham; above cited, p. 234.

the bladder be dreaded, puncturing the bladder must be performed without delay.

1798. In *Spasmodic Retention of Urine* (*Ischuria Spasmodica*) the neck of the bladder, and perhaps also the *urethra*, are narrowed at different parts, and accompanied with spasmodic contraction of the perinæal muscles. It occurs specially in sensitive persons, in hypochondriacs, in hæmorrhoidal affections, in which there is often at the same time present spasmodic contraction of the *m. sphincter ani*, from catching cold, inordinate drinking, worms, holding the water too long, and the like. This retention is always peculiar in sometimes subsiding and again recurring; it therefore has not the signs of inflammatory retention, at least in general they are not present, though they may at a later period accompany it.

1799. In this form of retention antispasmodic *remedies* are usually employed, warm applications of camomile, *hyoscyamus*, and the like, to the *perinæum* and region of the bladder; rubbing in volatile ointments, with opium or *ol. hyoscyami;* clysters of camomile, *asafœtida* and opium, tobacco clysters (*a*), lukewarm camomile hip-baths. Internally should be given Dover's powder, or opium, with mucilaginous remedies, *pollen lycopodii.* According to its various causes, should be employed, in hæmorrhoids, sulphur, with cream of tartar; in colds, diaphoretic remedies, especially camphor in proper doses; in worms, anthelmintics; and according to the fancy, unfermented drinks, calcined *magnesia*, with aromatics; and the *glans penis* to be put in cold water.

1800. If by this treatment the urine do not flow, a catheter must be introduced, which always discovers a considerable obstacle at the neck of the bladder, sometimes even in the passage of the instrument in the *urethra.* If inflammatory accompany the spasmodic symptoms, the antiphlogistic must be added to the antispasmodic remedies. If the retention of urine have occurred from having voluntarily retained it for a long time, in which case the symptoms are always more severe on account of its greater quantity, the treatment must immediately commence with the introduction of the catheter.

1801. The *retention of urine which depends on stoppage of the urethra* may be produced by stones in the bladder, when they lie upon the inner aperture of that canal, or if being small, they have squeezed into it (1); by coagulated blood (2), or thickened mucus; by worms which pass out with the urine (3); by foreign bodies which have been passed from without into the *urethra* (4). In all these cases the *urethra* is either completely closed by the foreign body, or in consequence of the irritation and spasmodic contraction which they have excited.

[(1) Stones, if small enough to escape from the bladder, may, according to their size, either pass through and be voided by the *urethra*, or they may be fixed in either of its narrower parts. I have known them lodge in the membranous part, and require removal by cutting through the *perinæum;* but more commonly they get jammed within an inch of the lips of the *urethra*, of which I have seen many instances.

In the Museum at the College of Surgeons, there is a very remarkable instance of a case which occurred to John Hunter, in which a narrow stricture in the membranous part of the *urethra* was blocked up by a very small stone, hardly more than a line in diameter; it is figured, in his work, *On the Venereal Disease,* (pl. iv.) and the short notice attacked to it is, that the man "died of a mortification of the bladder, in consequence of a stricture and stone in the *urethra.*" This preparation is interesting, as the stated cause of Hunter's beginning to use caustic bougies, for he adds, "a canula is

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(*a*) Earle, Henry, On the use of Nicotiana in Retention of Urine; in Medico-Chirurg. Trans., vol. vi. p. 82. 1815.

introduced from the *glans* down to the stricture, showing the practicability of destroying it with caustic." In the same collection, there is also another instance of a stone in the *urethra* behind a stricture, in a boy of four years old, to which he refers, (p. 124,) in the same work.

(2) Howship (*a*) gives a good example of blood filling the bladder, in an elderly man, who was attacked with what was at first supposed to be a retention of urine, and a catheter having been repeatedly passed without any urine escaping, it was thought not to have entered the bladder. He died on the following day, and on *examination*, the bladder was found entirely filled with a very large coagulum. In another case, he mentions the bladder being nearly filled with blood, and containing a stone in the centre of the clot.

When blood is found in the bladder, it is more commonly from fungous growths either from the bladder itself, or from the prostate, of which Bransby Cooper (*b*) gives good examples.

The case of Mathieu's, quoted by Samuel Cooper (*c*), appears to me nothing more than an enlarged prostate, which the catheters first used were not of sufficient length to reach beyond, and not retention from a clot in the bladder.

I have known, in two or three instances after the operation for the stone, blood to flow back into the bladder, and there coagulating, prevent for a time the escape of urine, either from the *urethra* or from the wound. Indeed, if for some hours after the operation, urine do not pass from the wound, it may, be presumed something of this kind is going on, and the bladder requires gently washing out, through the wound, with a syringe.

(3) Lawrence (*d*) relates a very remarkable instance of an undescribed species of worms voided from the *urethra*, to the amount of from eight hundred to a thousand, by a woman, aged twenty-four years.

He also mentions examples of the *larvæ* of insects having been passed. Of discharges of worms and insect *larvæ*, and portions of the lining membrane of the bladder, which have been mistaken for them, there is no lack in the accounts of various writers.

(4) Foreign bodies, of various kinds, have frequently been purposely introduced into the *urethra*, and escaping from the fingers of the holder, have either lodged in it, or more generally slipped back into the bladder. Bougies, and elastic catheters, and even those of metal, have been thus occasionally circumstanced by accident, the whole of the former being sucked in, as it were, by the bladder; and the latter having been broken, being pushed in by unskilful endeavours to prevent their escape backwards. But tobacco-pipes used as substitutes for bougies, are probably the most common foreign bodies which are met with in the *urethra* or bladder. Tyrrell (*e*) had a case in which the patient broke off three inches of the curve of a silver catheter, which slipped into the bladder. He walked to St. Thomas's, a distance of about twenty-one miles from his residence, without much inconvenience, except that "occasionally in stooping, walking up stairs, or raising himself in bed, he experienced lancinating pain, as if some sharp instrument were penetrating the bladder. * * * On passing a sound, it was found lodged at the *fundus* of the bladder transversely; its extremities being embraced by that *viscus*, so as to be held with some firmness." It was brought lower with a sound, but still remained transverse. Tyrrell "then introduced one of Weiss's instruments for extracting small *calculi*, which was nearly straight, and had a strong spring; by careful examination with which, he discovered that the extremity of the foreign body towards the patient's right side was free, and that the other was covered with a fold of the bladder. After several unsuccessful attempts, he succeeded in seizing the free extremity with the instrument, and by withdrawing it very cautiously, brought the piece of catheter into the *urethra*, when the forceps slipped from it. He immediately introduced his fingers into the *rectum*, for the purpose of compressing the *urethra* between the foreign body and the bladder, so as to prevent any retrograde movement of the former. This being secured, he again introduced the forceps into the *urethra*, and in the first attempt caught the piece of catheter, and drew it out."

I am indebted to my friend Crisp, of Walworth, for the two following highly interesting cases, which were treated by him:—

Case 1. An old sailor had been in the habit of passing the whole length of a tobacco-pipe into his *urethra*, for the relief of stricture, and on one occasion broke off a piece of it, which slipped into his bladder, and for which the usual operation for the stone was performed in Guy's Hospital, and he recovered. This accident, however,

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(*a*) Above cited, p. 54.

(*b*) Guy's Hospital Reports, vol. i. p. 202.

(*c*) Surg. Dictionary, p. 1375.

(*d*) Med.-Chir. Trans. vol. ii. p. 382.

(*e*) St. Thomas's Hospital Reports, p. 26.

did not prevent him subsequently recurring to the same mode of treatment, when the pipe again broke, leaving about an inch and a half in the membranous part of the *urethra.* This he attempted to remove, by making a cut with a penknife into the *perinæum,* as he lay before a glass, and succeeded in exposing the pipe, but being unprovided with instruments, and failing, by groping with his finger, to get it, he was obliged to send for my friend, who drew it forwards with a pair of dressing forceps, and readily removed it. The man did well.

Case 2. A man in Walworth workhouse, having made frequent attempts to commit suicide, at length, for the same object, passed a piece of stiff wire, about five or six inches long, into the *urethra,* as far as he could, and afterwards drove it with his fist under the arch of the *pubes* into the *pelvis.* By pressure on the *perinæum,* the extremity of the wire was indistinctly felt. A cut was made into the *urethra* behind the bulb, about an inch and half in length, but the wire end not being seen, the cut was lengthened backwards about half an inch, which exposed the extremity of the wire. Much difficulty was found in seizing the wire, as at each attempt it receded with the soft parts, when the points of the dissecting forceps (which only could be used, on account of want of space) were introduced; but when seized, it was readily withdrawn, and the man recovered.

John Hunter says, that "bougies have been known to be forced out of the bladder along with the water, by the action of that *viscus,* and in several folds. (p. 134.) This is certainly a very rare occurrence, but, by no means, impossible or improbable; for there is a preparation in St. Thomas's Museum, of a large adventitious membrane, four or six inches long, and an inch and a half wide, which was voided by the *urethra;* and it is only necessary for the bougie to be so situated, as to form a sort of plug, against which the urine behind may be driven forwards.—J. F. S.]

1802. If a vesical stone lie against the neck of the bladder, and produce ischury, the same proceeding as in inflammatory ischury, must be had recourse to, and the stone removed from the neck of the bladder, either by placing the patient on his back, with his *pelvis* raised, or by introducing a catheter. Lumps of blood and collections of mucus in the *urethra* are also relieved by passing the catheter. If small stones or other hard bodies stick in the *urethra,* itself, it must be attempted, by employing, at the same time, antiphlogistic and antispasmodic remedies, to squeeze them gradually out of the *urethra,* or with Hunter's or Cooper's forceps to withdraw them, after having carefully enlarged the passage by introducing thick bougies, especially of silkworm gut. If the object be not thus attained, a cut must be made, where the foreign body is situated, and thence it must be removed (1): a catheter is to be left in afterwards, and the edges of the wound tried to be healed with quick union (2).

Retention of urine from small stones, which have got into the mouth of the *urethra,* or into its membranous part, is probably much more frequent, than generally supposed; in which case the *diagnosis* is doubtful, and if the catheter be introduced, the little stone cannot be felt, and the retention on the contrary, is to be considered inflammatory or spasmodic. As symptoms of such *ischuria calculosa* may be to a certain degree considered their occurrence after any mechanical movement, without other previous influence and their cessation after such shaking. For the removal of these little stones, when the introduction of a catheter is not possible, for instance, when there are existing strictures, injections of water, made with some force into the *urethra,* must be employed; together with rubbing and shaking the *perinæum,* but the bladder must not be previously overloaded, or the *urethra* considerably inflamed (*a*).

[(1) If a stone or any other body be near the lips of the *urethra,* it may often be removed with a little dexterity and patience, by curving the eyed end of a probe, and gently insinuating it between the stone and the *urethra,* till the point be got behind it; then using the probe as a lever, it may be gently drawn forwards, and if when the stone reach the orifice of the canal, it will not pass, a small nick with a lancet at that part of the aperture, where it most clings, will soon allow it to come out. If the stone or body be in the membranous part, if the forceps fail in catching hold and pulling it out, a cut must be made directly down upon it. But in doing this it will be necessary to introduce

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(*a*) Schreger, Chirurgische Versuche, vol. i. p. 187.—Cloquet, I.; in Journ. de Médecine, vol. ii. p. 19. 1818.

the forefinger of the left hand into the *rectum*, so as to fix the stone and prevent it slipping or being pushed back into the bladder, in the attempt to seize it: for should that happen, it will be necessary at once to perform the usual operation for stone.

(2) If the cut be made in the *perinæum*, no catheter should be left in, but the wound allowed to heal, as after the operation for the stone. But if the *urethra* be opened before the *scrotum*, and specially if near to it, a catheter must be left in, to prevent the escape of the urine into the cellular tissue.—J. F. S.]

1803. In *retention from the pressure of the impregnated womb*, or *other viscera*, the palliative treatment consists in introducing the catheter: in the former case the ischury ceases after delivery; in the latter the hardening of the *viscera* must be got rid of, as well as other swellings which compress the *urethra*. Retention from retroversion of the womb has been already considered (*par.* 1308.)

[I once operated for retention of urine in a case which, after death, was found to depend on a large cyst, containing an acephalous hydatid, which occupied the whole cavity of the *pelvis*, and lying between the bladder and the *rectum*, compressed the former between itself and the *pubes*, and as the bladder filled, it rose high above the brim of the *pelvis*, in consequence of which, even after cutting into the *perinæum*, the pressure was so complete that the urine would not escape, except on the introduction of a very long catheter, which was continually displaced by the contraction of the bladder into the compressed part, into which no urine descended, and was only replaced with the greatest difficulty. The man died on the sixth day of constitutional irritation. Besides this cyst above mentioned, which contained 44 ounces of colourless fluid enclosed in the hydatid, there was another, about the size of a goose's egg, at the lower part of the sigmoid flexure of the *colon*, with thick walls, and an eschar upon it, where it had probably, at some time or other, burst. The bladder was empty between the lower and fore part of the large cyst and the arch of the *pubes;* and between the cyst and the back of the *fundus* of the bladder were two or three small cysts of the size of small nuts, and upon the fore part of the *fundus* another as big as a swan's egg. All the cysts contained each an hydatid, except that on the *rectum*, on which there were several.—J. F. S.]

1804. *Growths in the bladder*, especially about its neck, are causes of ischury, and the diagnosis is always uncertain. Sometimes there is only one growth of much size, sometimes several: some have a thin stem, and others a broad base. The use of the catheter is the only palliative. Such growths when discovered in the operation for the stone, have been torn away with the forceps (*a*).

1805. *Swellings of the prostate gland* may arise in various ways, and the passage of the urine become difficult, or quite impossible. The swelling may depend on inflammation, varicosity of the vessels, hardening, and stone.

1806. *Inflammation of the prostate gland* may be consequence of *gonorrhœa*, of external violence, and the like; in general, it developes itself quickly. The patient has a sense of weight and burning in the *perinæum* and *anus*, a throbbing pain, the seat of which he refers to the neck of the bladder. The pain increases on pressure of the *perinæum*, and specially on going to stool: the patient has difficulty and frequent urging to void his urine: the swelling of the prostate is felt on introducing the finger into the *rectum*. In proportion to the degree of inflammation, occur inflammatory symptoms and so on. If the inflammation do not disperse, it may pass on to suppuration. Under these circumstances, after the inflammatory symptoms have gone over eight days, a throbbing pain is felt, increased fever towards evening, shiverings, and symptoms of retention of urine, which subside a little, and increase afresh. The suppuration rarely appears to be seated in the proper substance of the gland, but rather

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(*a*) Desault; above cited, p. 175.

in its coverings, and in the cellular tissue, connecting the lobes of the gland; frequently several groups of abscesses form, and in this case the patient generally sinks, some abscesses opening within, and others without, the abscesses burrow, and fistulous passages, and wasting suppuration ensue.

[" As the abscess advances, the *perinæum* becomes tender," says **Brodie**, "and there is a perceptible, though slight tumefaction and hardness in some one part of it. The abscess, if left to take its own course, sometimes bursts internally, that is, into the *urethra*; more frequently, it makes its way through the *fascia*, cellular membrane, and muscles of the *perinæum*, and bursts through the external skin." (p. 144.) **Brodie**, however, mentions a fatal instance of abscess in the prostate, in which the patient, about thirty years of age, voided his urine every twenty or thirty minutes, complaining of an aching pain in the loins; but of no pain any where else. The urine deposited a small quantity of yellow puriform sediment. He said that the symptoms had begun two years ago, and that in the commencement of the disease, the urine had been tinged with blood. * * * About a month after his admission into the hospital, he was seized with symptoms of apoplexy, and died in the course of a few hours. * * * An abscess of the size of a large walnut occupied the posterior part of the prostate, and extended into the space between the bladder and *vasa deferentia* behind the neck of the bladder. * * * An irregular ulcerated orifice was discovered behind the *verumontanum*, through which the probe passed at once into the cavity of the abscess." (p. 146.)]

1807. The *treatment* of retention of urine from inflammation of the prostate, agrees precisely with that of inflammatory retention already described (*par.* 1795); blood-letting, leeches about the *anus*, baths, soothing clysters, poultices to the *perinæum* and the like. If the flow of urine be not thereby effected, the catheter must be introduced, which, however, can never be done without difficulty and great pain; because the swollen gland alters the direction of the *urethra*, on which account also a catheter with a long beak is required, and sometimes must have a large curve (1). If an abscess form in the prostate, the introduction of the catheter is the only remedy; the abscess is either opened by it, in doing which care must be taken not to make a false passage, or it bursts of itself and the pus escapes with the urine (2). The catheter must remain in the bladder till the urine be no longer mixed with pus. **Desault** (*a*) recommends cleansing injections of barley water at the same time.

[(1) In reference to the enlargement of the prostate gland from acute inflammation, **Lawrence** (*b*) says:—" You should avoid, if possible, the introduction of a catheter. There is a pretty actively inflamed substance against which, in its introduction, the point of the catheter will necessarily come, and through which it must pass in order to enter the bladder. The introduction of an instrument, under such circumstances, must be expected to aggravate the sufferings of the patient at the time; and therefore, if you can put a stop to the inflammation, and enable him to make water without the employment of an instrument at all, it will be very desirable for you so to do. Trust therefore to antiphlogistic means, with which fomentations, the use of the hip or warm bath may be combined; and do not have recourse to the use of an instrument, unless these means fail, and there should be an actual necessity for relieving the patient from the danger which the difficulty of evacuating the urine produces. If you come then to the introduction of an instrument, you should be aware of the particular change in the *urethra*, which the swelled state of the prostate produces. The swelled prostate does not diminish the dimensions of the *urethra*, but it alters the course and shape of the canal in that part which goes through the gland; it presses the sides of the *urethra* together, and the swelling of the prostate, the principal part of which is situated below the *urethra*, that is, between the *urethra* and *rectum*, pushes the *urethra* up towards the *pubes*. At the same time, the enlargement of the prostate in size, an enlargement which takes place in all directions, increases the length of this part of the canal. The changes then produced are, first, an elevation of the *urethra*, pushed upwards towards the *pubes*, an elongation of the canal in its prostatic portion, and a pressing together of

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(*a*) Above cited, p. 229.

(*b*) Lectures in Lancet, 1829, 30, vol. ii.

the sides of it laterally. The best instrument in this case is a *large elastic catheter;* and, indeed, I should observe to you, whether you employ an elastic or a silver catheter in cases of enlarged prostate, you will always find it necessary to use an instrument *of full size*, which will pass on much more easily than instruments of small size. The best instrument is, the catheter made of elastic gum, and you should use those which are made to retain their curved shape without a stilette. * * * If, however, you should fail in introducing such an instrument, you must have recourse to the silver catheter," and "the extremity of the instrument should be prolonged, so as to represent more than a quarter of a circle; * * * a third or a quarter of an inch over that, so as to enable the end of the instrument to rise over the elevated part of the *urethra*." (p. 811.)

Brodie advises:—"If there be a retention of urine, the gum catheter, without a wire or stilette, may, in almost every case, be readily passed into the bladder. It is better to use a very small catheter, and to introduce it again, whenever it be necessary to do so, than to leave it constantly in the *urethra* and bladder." (p. 145.) As to the size of the catheter in enlarged prostate, under any circumstances I must confess I prefer the larger, as recommended by Lawrence, for the reasons he has assigned, which have been verified by my own experience; and a silver to an elastic catheter, on account of its greater firmness, which prevents mischief.—J. F. S.]

(2) "If there be reason to believe," observes Brodie, "that abscess is formed, you should endeavour to procure an external discharge for the matter, in order to prevent it bursting into the *urethra*. If the symptoms described exist, and go on for some time increasing, and you discover a fulness and tenderness of the *perinæum*, do not wait for any more certain indication of abscess; but introduce a lancet in the direction indicated by the tenderness and swelling. It will often be necessary to pass it quite up to the shoulders, or even to the handle, before you reach the abscess. But you may do this fearlessly. There is no danger from any ill consequence from such a puncture. If there be abscess, you will, by this proceeding, immediately relieve the distress which the patient suffers, at the same time that you prevent further mischief. If, on the other hand, there be no abscess, the puncture does not make the condition of the patient worse than it was before. Indeed, partly from the loss of blood, partly by removing the tension of the soft parts of the *perinæum*, it is generally useful to the patient, even when it does not answer the purpose of allowing the escape of matter." (p. 146.)]

1808. Swelling of the prostate gland *from varicosity of its vessels* occurs in general, slowly, in old persons after previous hæmorrhoidal ailments, in stoppage of the bowels, after venereal debaucheries, after repeated claps, with sedentary living and good living, after abuse of heating drinks, after frequent efforts in voiding the urine and going to stool. It is always developed slowly. Emptying the bladder becomes more difficult after violent exertion, after heating food and drink and the like. The swollen prostate is felt on introducing the finger into the *rectum*, but is free from pain, and the patient suffers no pain in the passage of the urine through the *urethra*. The varicosity is situated rather in the coverings of the prostate; the substance of the gland itself is therewith sometimes soft and spongy, sometimes tense and hard.

1809. If this disease have any distinct cause, it must be removed. In general, taking away blood from the *perinæum*, clysters of cold water or decoction of oak bark with alum, are sufficient. The introduction of the catheter is in this case always difficult, and the circumstances above mentioned (*par.* 1807) should be always borne in mind. Sometimes a swollen vessel is torn in passing the catheter, in consequence of which bleeding occurs, which gives relief. The inlying of a catheter is here necessary for the purpose of compressing the swollen vessels, and by its accompanying irritation to excite their contractile activity. The treatment is always tedious, and no cure is to be expected under six or eight weeks.

1810. *Hardening* is the most common diseased change to which the prostate gland is subject. It occurs after previous slow inflammation, most commonly after forty years of age, and earlier if the *urethra* be affected, especially in scrofulous subjects and in those who when young have indulged in venery; after repressed eruptions on the skin, and as the consequence of gout and the like (1). It always proceeds slowly; voidance of the urine becomes difficult, and is sometimes completely stopped. The prostatic humour is sometimes exceedingly copious and viscid. The direction of the *urethra* is changed according as the right, left or middle lobe of the gland is swollen. The hardened prostate is felt by examination through the *rectum*; the patient has difficulty in going to stool; a discharge of mucus-like fluid, an unusual sensation about the *rectum* after going to stool, as if the bowel were not completely relieved. All the symptoms described (*par.* 1675) as belonging to stricture, frequently accompany swelling of the prostate (2).

In reference to the secretion of a mucus- or pus-like fluid which may accompany the various diseased conditions of the urinary passages, it may be remarked that the more mucus-like, thick, pus-like deposit which the urine throws down, and which remains loose at the bottom of the chamber-pot, shows a catarrhal inflammation of the mucous membrane of the bladder; the mucus-like deposit which draws out in threads, is elastic like white of egg, and sticks to the bottom of the pot, characterizes disease of the prostate; purulent deposit, and the prostate gland small, soft and flattened mark its destruction by suppuration. If on examination the prostate be uninjured, the pus comes probably from the kidneys (*a*). The mucus from the prostate is not ammoniacal; the mucus from the bladder rarely appears in any great quantity without containing some earthy parts.

[(1) "Chronic inflammation of the prostate gland is," says ASTLEY COOPER (*b*), "the consequence of age, and not of disease. When this disease produces partial retention of urine it should be considered as a salutary process, for it prevents incontinence of urine, which, in old people, would almost constantly take place were it not for this preventive. It makes the urine pass slower than natural, but this may be excused when it is the means of preventing a continual wetting of the clothes." (p. 239.)

BRODIE observes:—"When the hair becomes gray and scanty, when specks of earthy matter begin to be deposited in the tunics of the arteries, and when a white zone is formed at the margin of the *cornea*, at this same period the prostate usually, I might perhaps say invariably, becomes increased in size. This change in the condition of the prostate takes place slowly, and at first imperceptibly, and the term *chronic* enlargement is not improperly employed to distinguish it from the inflammatory attacks to which the prostate is liable in early life. (p. 151.) The chronic enlargement of the prostate may be said to be a disease of a peculiar kind, having no exact resemblance to what we meet with in any other organ. It may, however, in some respects be compared to the chronic enlargement of the thyroid gland, known by the name of *bronchocele*. Like the latter, it is generally slow in its progress, and frequently, after having reached a certain point, if proper treatment be employed, it remains almost stationary for many years. It is, on the whole, a rare occurrence for it to terminate in ulceration or abscess, and the symptoms to which it gives rise, are, with a few exceptions, to be referred to the influence which the disease exercises over the functions of the parts in the neighbourhood." (p. 154.)

Although enlarged prostate is specially the disease of advanced life, yet ASTLEY COOPER says he has "known it occasionally occur in very young people. An instance of this kind happened in Guy's Hospital: a boy was admitted having symptoms of stone, in consequence of which he was sounded, and the operation of lithotomy was about to be performed; the sounding, however, brought on inflammation of the bladder, which terminated in the boy's death. Upon *dissection* it was found that the symptoms for which he had been sounded were produced by an enlarged prostate." (p. 245.)

"I have certainly seen a very few cases of it," (enlarged prostate,) says LAWRENCE, "in young persons, but the great majority of those you have to treat for this complaint are past the middle period of life." (p. 813.)

The part of the prostate gland in general considered as specially enlarged is that which JOHN HUNTER describes as that "*small portion of it which lies behind the very beginning of the urethra*, swells forwards like a point into the bladder, acting like a valve to the mouth of the *urethra*, which can be seen even when the swelling is not considerable, by looking upon the mouth of the *urethra* from the cavity of the bladder in a dead body. It sometimes increases so much as to form a tumour (of which HUNTER gives two engravings, V. and VII.) projecting into the bladder some inches." (p. 188.) It

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(*a*) LALLEMAND; above cited, p. 152.

(*b*) Lectures in Lancet, 1823, 24, vol. ii.

is this same part which EVERARD HOME has dignified with the name of third lobe of the prostate, and claimed the discovery of, without adding anything to what HUNTER had said about it, except that of the five cases he examined, and on which he grounded his claim, "the appearance," he says, "was not exactly the same in any two of them." (p. 10.) And yet this has got the name of HOME's third lobe, and is so continually called in spite of JOHN HUNTER's observation, and the knowledge that the French anatomists have long since been well aware of it under the name *trigone*. In reality, however, so far as I have had an opportunity of observing, the two principal or side portions of the gland are most commonly enlarged at the same time and in the same proportion as this small portion which lies behind.—J. F. S.

"The next thing noticed is," says ASTLEY COOPER, "that the urine has a particularly powerful smell, which arises from its being ammoniated in consequence of some urine remaining in the bladder after each discharge. * * * The next symptoms are pain and numbness in the *glans penis;* sense of weight and uneasiness in the *perinæum*, relieved by pressure with the finger; pain in the back of one or both thighs, in the loins. and at the origin of the sciatic nerves, and in the course of the ureters; the *fæces* are flattened, from the pressure made upon the *rectum* by the swollen gland. Persons having enlarged prostate for any length of time, generally have, likewise, *prolapsus ani* and hæmorrhoids. * * * The ammoniacal smell of the urine as the disease advances, becomes highly offensive, and at length the urine itself becomes white or milky; this appearance shows that the inflammation has extended to the mucous membrane of the bladder. If the urine be much retained, it has the appearance of coffee, occasioned by an admixture of blood with it; this leads many practitioners to suppose, for the moment, that the case is one of stone; but if you question the patient for a few moments, your doubts on this point will be removed." (p. 240.)

"Upon dissection," continues ASTLEY COOPER, "the prostate is found enlarged sometimes laterally; but most frequently the enlargement is in the posterior part, situated in the middle or third lobe. As the prostate enlarges it is pushed forwards, in consequence of which the *urethra* becomes curved immediately before the *apex* of the prostate; indeed, the coming forward of the prostate causes the *urethra* almost to double upon itself. The curve thus formed is at the *symphysis pubis ;* and it is in this situation that the difficulty on passing the catheter in diseased prostate is found. Tracing on the course of the *urethra*, behind the curved part, that canal is seen much enlarged, and the *urethra* itself is considerably elongated, that is, from an inch and a half to two inches; which increase of length is behind the *pubes*, and it is owing to this circumstance that you are under the necessity of carrying on the catheter so great a distance after its point has passed the arch of the *pubes*. As to the prostate itself, we find that it may increase to a most enormous size laterally without giving rise to retention of urine; but that enlargement which occurs posteriorly in the third lobe, frequently occasions retention of urine, for the enlargement is situated immediately behind the orifice of the *urethra ;* thus the urine collecting behind the swelling presses it against the mouth of the *urethra*, and forms a complete barrier to its passage." (pp. 241, 42.)

"This tumour," (of the third lobe,) observes BRODIE, "varies in size from that of a horse bean to that of an orange. When small, it is of a conical form, with the *apex* of the cone projecting into the bladder, and the basis being continued into the rest of the prostate. When large, the basis is often the narrowest part, and it swells out so as to have a pyriform figure towards the bladder. In some instances, by the side of that which I have just mentioned, there is another tumour, formed by one of the lateral portions, also projecting into the bladder. The canal of the *urethra*, where it passes through the enlarged prostate, is generally flattened; and when the latter is divided transversely, the *urethra* appears like a slit, rather than like a cylindrical canal. Not unfrequently the enlargement of the prostate so alters the form of the *urethra*, that, instead of pursuing a straight course through the gland, it is inclined first to one side and then to the other. You would expect the *urethra* to be narrow, in consequence of the increased bulk of the parts by which it is surrounded; and so it is in many instances; in others, however, it is actually wider, being dilated into a kind of sinus, where it lies in the centre of the prostate. I have known such a sinus to contain two or three ounces of fluid." (pp. 152, 53.)

(2) ASTLEY COOPER asks:—"How, when diseased prostate exists, are you to know it? What are the diagnostic signs? Why, the enlargement laterally may be readily ascertained by introducing the finger into the *rectum ;* but the enlargement of the middle lobe cannot be so learnt. In what way then? Why, by the introduction of a catheter or bougie, and the latter is best; it will be found to stop suddenly; you are then to introduce a catheter for the purpose of drawing off the water; the instrument will

be resisted in its common course, and you must depress the handle a good deal, with a view of tilting its point over the enlarged gland; thus the end of the instrument will be rising perpendicularly, as it were, behind the *pubes*. These, then, are the means you are to employ to obtain a correct *diagnosis*." (pp. 242, 43.)

"The symptoms of retention of urine from enlargement of the prostate, are not very different from those which occur where the retention is the consequence of stricture, but the termination is different. I never saw," says Brodie, "a case in which, under these circumstances, the bladder had given way, as sometimes happens, where there is a retention from stricture; but I am informed that such a case has occurred, and that the bladder ruptured at its *fundus* is preserved in the Museum of St. Bartholomew's Hospital." (p. 155.)]

1811. The *prognosis* in this disease is always unfavourable. Only in the beginning is there hope of being able to disperse the hardening; in advanced cases, the disease may sometimes be diminished, and the patient's condition may be rendered tolerable by the inlying of the catheter. At the first a corresponding antiphlogistic treatment must be employed; afterwards issues and blisters to the *perinæum*, rubbing in volatile liniments with camphor, mercurial ointment, iodine salve, suppositories of *cicuta* and *opium;* internally, *cicuta*, mercury, decoction of *daphne mezereon*, *uva ursi*, and the like, but especially hydrochlorate of ammonia in increasing doses (*a*). If the hardening have a definite cause, the curative means must be directed to it. In introducing the catheter, the points already mentioned (*par.* 1807) must be considered. If an elastic catheter be left in, it does not retain its proper curve after the removal of the stilette, and the urine escapes; it is better, therefore, to use those elastic catheters, which have a permanent curve.

[As to the treatment of enlarged prostate, Astley Cooper says:—"Very little can be effected here by medicine; it is a disease over which medicines have but very little influence. You may, however, give the oxymuriate of mercury in very small quantities, for I believe I have seen it, beneficial. But this is the treatment only for the enlargement of the gland. * * * When no urine whatever can be passed, and when there is great pain at the neck of the bladder," he recommends to "take blood from the arm, apply leeches to the *perinæum*, administer purgatives, and put the patient in a warm bath. If these means should succeed in procuring relief, the best medicine that can afterwards be given for the purpose of preventing a return of the retention, and at the same time of lessening the inconvenience which sometimes attends the complaint, is composed of fifteen drops of the *liquor potassæ*, five drops of *bals. copaib.*, and an ounce and a half of *mist. camph.* If you give fifteen or twenty drops of the balsam it then produces a stimulating effect, and does harm; administer it in the quantity just mentioned, in conjunction with the other medicines, to which may be added two drams of *muc. gum. acac.* * * * Other medicines, as the carbonates of *soda* and *magnesia*, the *liquor potass.*, with *opium*, are occasionally given, but as the latter produces costiveness it is improper. The first medicine will be found the best; it will afford considerable relief, which is all that you can expect, for you must not dream of making a cure." (pp. 243, 44.)

Lawrence says:—"In the case of this chronic enlargement of the prostate, we have not much power of relieving the patient by producing any great reduction of the affected part. * * * By attention, however, to diet, careful attention to the state of the stomach and bowels, by a course of mild alterative and aperient medicines, we can keep the patient perhaps in a tolerably healthy state. Attempts have been made sometimes to reduce this enlargement by seton or issue on the *perinæum* or upper part of the thigh, but it is an inconvenient course of proceeding, and one to which patients are not inclined to submit." (p. 813.)

"When from any cause the vessels of the prostate are more than usually turgid with blood," says Brodie, "the quantity may be diminished, and thus a reduction of size, to a certain extent, may be effected. It is with this view that we recommend topical blood-letting, the exhibition of gentle purgatives, a moderate diet, and, above all, perfect rest in the horizontal posture. But we are not acquainted with any method of treatment which is capable of restoring the gland to its original condition." (p. 173.)

(*a*) Fischer; in Rust's Magazin, vol. xi. p. 284.—Cramer; in Hufeland's Journal, 1824, p. 35. See also Home, Everard; Practical Observations on the Diseases of the Prostate Gland, vol. i. London, 1811; vol. ii. 1818. 8vo.

"The treatment of retention of urine from diseased prostate," observes Brodie, "is one of the most important subjects in Surgery. The patient suffers miserably; his life is at stake; he lives or dies according to the skill which you are able to exercise in his favour. The case is altogether different from one of retention of urine from stricture. Bougies are of no service; even if you pass one into the bladder, no urine follows; the parts collapse and close as the bougie is withdrawn." (p. 174.)

Astley Cooper lays down that when "called upon to relieve retention from enlarged prostate, by the introduction of a catheter, the instrument should be fourteen inches in length, and a quarter of an inch in diameter. In consequence of the pressure within, a broad instrument will answer better than a narrow one, for being bulbous at the end it will readily ride over the enlargement. When introducing the catheter, you will meet with no difficulty until you reach the curve which the enlargement of the gland has produced in the *urethra;* the handle of the instrument is to be here slightly raised, for the purpose of insinuating the point through the curved part. Having passed this you are then to depress the handle completely between the thighs, so as to occasion the point of the instrument immediately to rise perpendicularly above the *pubes.* * * * This will cause the point to enter the bladder between the *pubes* and enlarged lobe. * * * "If it be deemed requisite to leave the catheter in the bladder, I should prefer," says Cooper, "one of pewter rather than elastic gum, for it can be curved down before the *scrotum,* and by plugging up the end, the patient may move about as he likes, and at any time he wishes can expel his urine. * * * The pewter catheter should be quite new, and ought not to be worn for a longer period than a fortnight, for the urine acts upon the metal, renders it brittle, and may probably cause the instrument to snap, if the time be extended beyond what I have stated. If there be need of puncturing the bladder for enlarged prostate, it must be done above the *pubes*; but it never need be attempted at all if you can perform your duty." (p. 243-45.)

"In instances where the bladder does not evacuate its contents completely, where there is a constant accumulation of urine within it, the course you have to pursue," says Lawrence, "is to introduce the catheter regularly once or twice in the four-and-twenty hours, so as to draw off the stale urine, and to give the bladder the opportunity of recovering its power of contraction; and after following this up for some time, perhaps two or three weeks, you generally find that the evil is removed, and that the patient recovers the power of completely emptying the bladder. * * * It is necessary that the catheter should be longer than that which is employed under ordinary circumstances; give it the length, perhaps, of fourteen inches, curved as already stated, and always use a catheter of full size. * * * In such cases where the smallest catheter could not be introduced, I have repeatedly succeeded in introducing an instrument of this size with the greatest ease." (p. 813.)

Brodie "rarely uses any but a gum catheter. It gives you rather more trouble to learn the use of the gum catheter, and to become dexterous in the management of it, than it does to learn the use of the silver catheter. When, however, you have once become familiar with the gum catheter, you will generally prefer it to the other; and there is always this advantage in it, that when you have succeeded in introducing it into the bladder, it may, if necessary, be allowed to remain there. A gum catheter may be retained in the *urethra* and bladder with very little inconvenience to the patient, which is not the case with a silver catheter." (p. 175.)

Brodie uses, as did Home, the gum catheter without a wire, as a flexible, or with a wire as an inflexible instrument; and directs that it should not be mounted on a small flexible straight wire, but on a strong iron stilette, having the curve of a silver catheter. He begins with passing a gum catheter without a stilette; if it will enter the bladder, so much the better; it gives no pain, does not lacerate the *urethra,* nor produce hæmorrhage; it may do all that is required, it can do no harm, even in a rough hand; failure will not render it more difficult to pass another instrument. In difficult cases indeed it will not succeed, and then the catheter with the iron stilette must be used. "You ought not to use a catheter so large as to give pain; but for the most part you will find one which is large enough to fill the *urethra,* without stretching it, to be more easy of introduction than a smaller one, which approaches to a pointed instrument, and the extremity of it is liable to become entangled in the tumor of the prostate. The stilette ought to be considerably curved; the reason of this is obvious. (p. 176.) Always bear in mind, in introducing the catheter, that it is to be used with a light hand. It should be held, as it were, loosely with the fingers. It will then, in great measure, find its own way in that direction in which there is the least resistance. If you grasp it firmly, it can only go where you direct it, and it is likely to puncture and lacerate the membrane of the *urethra,* and the substance of the prostate, and to make a false passage instead of entering the bladder. [Most excellent directions, and cannot be too closely followed.—J. F. S.] I generally find," continues **Brodie**, "that I introduce the catheter best by keeping the handle of it close to the left groin of the patient. I pass it as far as possible in this position; then I bring the handle forwards, nearly at a right angle to the *pubes*, and not elevating it towards the navel. The next thing is to depress the handle, which is to be done gently and slowly, by placing a single finger on it, and pressing it downwards towards the space between the thighs. In depressing the handle, you generally find the point of the catheter slide into the bladder. Sometimes, however, this does not happen until you withdraw the stilette; and in the act of doing this, the introduction of the catheter is completed." (p. 177.) " I do not mean to lay it down absolutely as a rule, that you should allow the catheter to remain, but I am certain that it is prudent to do so in the great majority of cases. If you remove it, so abundant is the flow of urine which immediately takes place from the kidneys, that you will find the bladder again loaded, and requiring the re-introduction of the catheter within five or six, perhaps even within three or four hours. It will be necessary to use the catheter again after another short interval, and it will often happen, when there has been no difficulty in the first introduction of it, that there is considerable difficulty afterwards. You avoid all this by leaving the catheter in the bladder; and there is another advantage in this mode of proceeding. The prostate is kept in a state of more complete repose, and in one much more favourable to recovery, so far as recovery can take place, that it would be in, if irritated by repeated introductions of the instrument." (p. 180.) "You will *very rarely* fail, by dexterous management, to introduce the catheter, but you *may* fail, nevertheless, in some instances. What is to be done under these circumstances? * * * You may puncture the bladder above the *pubes*, or you may proceed thus: When all your efforts to introduce the catheter have been unavailing; when you feel the point pressing against the tumor of the prostate, and unable to pass over it, apply some force to the instrument at the same time that you depress the handle. It will generally penetrate through the prostate, enter the bladder by an artificial opening, and relieve the patient; and, of course, will continue to relieve him, if you allow it to remain in the bladder. This mode of proceeding has been strongly recommended by some very good Surgeons, and I am not aware that it is attended with danger, although it may not be without its disadvantages. There is reason to believe, that in some cases in which this has been done, the natural orifice of the *urethra* has become so closed, that the patient could never void a drop of urine by his own efforts, being compelled to rely wholly on the catheter ever after. Sir **Everard Home** has published the history of a case of this kind, which was attended by Mr. **Hunter** and himself." (pp. 181, 82.)

With regard to the question of introducing the catheter twice or thrice a day, or, after having introduced it, to leave it there, I must confess I prefer the former, and the use of a large silver catheter; occasionally, it is true, there is some difficulty; but, in general, so far as my experience has proved, the catheter, after having been passed a few times, enters the bladder as readily as a sword into its sheath. On the other hand, I have found that leaving the catheter in for a time, is liable to render the bladder irritable; and that if at the end of a week or ten days, it be withdrawn, it is almost invariably found encrusted, more or less, with calcareous matter, which often renders its withdrawal difficult, and generally causes much pain, if not further mischief, by its roughness.—J. F. S.]

1812. If in *strictures of the urethra*, complete retention be produced either by the use of heating drinks or other excess, or by the progress of the disease itself, the most proper treatment is to introduce a fine wax bougie, which when its point has got into the opening of the stricture, is there held, as is distinctly shown in the vain attempts to draw it back. So soon as it will not move on without using violence, it must not be forced farther, but allowed to remain, till a violent disposition to make water come on, when it must be withdrawn, and the urine generally flows out in a thin stream. Some persons immediately introduce a bougie, which generally passes further, and may remain till the urging to void the urine comes on. At the same time, according to circumstances,may be employed blood-letting, leeches to the *anus* and *perinæum*, baths, soothing clysters, with opium and the like. After repeated introduction of the bougie, in general a thin elastic catheter may be passed into the bladder. If by these means the danger of the retention be removed, then the treatment of the stricture must be commenced according to the former rules.

Amussat (*a*) recommends the employment of forcing injections in cases of retention of urine dependent on stricture. He introduces a flexible cathether, without a beak, down to the obstruction, compresses the *penis*, and screws on to the end of the catheter a gum-elastic bottle, by which fluid can be injected and drawn out again. Lallemand and Begin (*b*) think it must not be forgotten that forced injections may be useful, if employed with moderation and prudence, and after the use of antiphlogistics and attempts to introduce bougies have been fruitless; but that in such case care must be taken not to use too great violence, for if a plug of mucus be the only or principal cause of retention, it will give way without any violent efforts, and if the parts be dilated by separating them, the power exercised in their contraction being equally on all parts of the *urethra*, which the fluid fills, it will produce severe pain and increase the inflammation; or what is worse, may find some part of the canal which is more friable and weak, and tear it.

[The treatment which a stricture producing retention of urine, will admit of depends principally on the degree of distension of the bladder, and the irritability of the patient. Attempts should always be made to introduce the catheter both before and after drawing blood quickly from the arm, and placing the patient in a warm bath, so as to induce faintness. The catheter should be used with great care and tenderness, to avoid the formation of false passages, which are too frequently made in striving to pass an instrument on these occasions. If the catheter cannot be got in, and the symptoms be urgent, it will be advisable to open the *urethra* from the *perinæum*, and if there be a stricture, to cut through it, so that the cure of the wound and of the stricture may go on together. It is better to resort to this practice early, if the retention be complete, rather than to wait till the *urethra* burst behind the stricture, and extravasation of urine take place; as by so doing the wound heals nearly as after the operation for stone, without much difficulty, and the patient is saved from the trouble and danger of sloughing of the cellular tissue and urinary abscesses. If, on the contrary, the symptoms be not urgent, and the retention have not existed many hours, it is advisable to give tincture of muriated iron in sufficient quantity to produce nausea, by which sometimes, the spasm, which almost invariably accompanies a stricture with retention, is relieved, and the patient passes his water. Purging also of watery stools is also very often efficient in relieving retention, for which purpose a couple of drams of sulphate of magnesia, with fifteen or twenty drops of tartarized antimonial wine, with mint water, may be given every two or three hours, till the medicine operate freely, and then, generally, the water begins to pass. Cutting into the *urethra*, however, should never be deferred when the retention is not, after a few hours, relieved, either by these means, or by the catheter.—J. F. S.]

1813. If by these means no evacuation of the urine can be obtained, and the symptoms become urgent, then puncture of the bladder is required. For this purpose, several writers have recommended *breaking through the stricture*, that is, with a silver conical pointed catheter to penetrate forcibly through the stricture into the bladder, to allow it to remain there several days, and then after a certain time, to introduce an elastic catheter for the purpose of keeping open the canal of the *urethra*. This proceeding, which is especially founded on Desault's observations and particularly defended by Boyer, is unquestionably, even in the ablest hands, most highly dangerous, as tearing the *urethra*, false passages, perforation of the bladder, severe pain and inflammatory symptoms so easily follow it. The firmer the stricture and the greater its extension, the earlier are these consequences to be dreaded. Only in strictures of slight extent, which have not been thickened and increased by frequently repeated inflammation from previous attempts with bougies or caustic, does this method seem applicable. Even in these cases, the use of a conical, pointed sound, will easily produce the above-mentioned symptoms, and the use of a thick sound with a rounded end, as proposed by Mayor, is still the most

(*a*) Archives Générales de Médecine, vol. ix. p. 294, 1825.—Magendie; Journal de Physiologie, vol. vi. p. 97. 1826.

(*b*) Dictionnaire de Médecine et de Chirurgie pratiques, vol. xiv. p. 344.

preferable, as being accompanied with much less danger of forming false passages and tearing the *urethra.* Under all other circumstances, if the symptoms be pressing, puncture of the bladder deserves undoubted preference.

Upon breaking through the stricture, the following may be compared :—Desault, above cited, p. 244.—Roux, Relation d'un Voyage fait à Londres, etc., p. 314. 1815.—Boyer, Traité des Maladies Chirurgicales, vol. ix. p. 232.—Cross, Sketches of the Medical Schools of Paris.—Charles Bell, above cited, p. 148.—Ducamp, above cited, p. 79.—Mayor, Sur le Cathétérisme simple et forcé, etc. Paris, 1836. Second Edition.—A. Vidal de Cassis, Lettre chirurgicale à M. Mayor. Paris, 1836.—Mayor, Sur le Cathétérisme, en reponse à une Lettre chirurgicale de M. Vidal. Paris et Genève, 1836.—Principes fondamentaux du Cathétérisme ; in Gazette Médicale, vol. vii. p. 353. 1839.

Of Cutting into the Urethra in the Perinæum.

In retention of urine caused by stricture Eckström (*a*) has proposed a less dangerous method of effecting puncture of the bladder, and has pursued it with happy results. After the patient has been placed as in the operation for the stone, a gum-elastic catheter is carried down to the stricture, and held firmly by an assistant, who at the same time, when the stricture is behind the *scrotum,* as is usually the case, lifts the *scrotum* up and stretches the skin of the *perinæum.* The Surgeon, with a pointed bistoury, then makes, nearly the length of the *raphe,* and in the direction given by the sound, a cut an inch and a half long through the skin, lays bare the *urethra,* that the course of the sound and its extremity can be traced. The patient is then desired to strain for the purpose of making water, by doing which, the *urethra* behind the stricture is distended and hard, a cut is now made into the *urethra* towards the sound, and the opening thus produced is enlarged to and through the stricture and sometimes behind it. The point of the fore-finger of the left hand must never for a moment during this operation leave the point of the knife, but must serve as a director. The urine now springs out with violence, and the bladder is emptied ; but if this do not readily happen, on account of the palsy of the organ from distension, a female catheter must be introduced into the wound, by the aid of which, the tapping is effected. If no severe symptoms of inflammation or irritation exist, which however, is very commonly the case, a common silver catheter No. 6 is to be introduced into the bladder. When its extremity reaches the wound, that is, the spot where the stricture was, it must be continued deeper, the finger in the wound giving it the proper direction, so that it may not slip from the *urethra,* but go directly into the bladder. When this has been once effected, and the instrument has been left in the bladder two to four hours, there is no fear of the least difficulty in its re-introduction, and a flexible catheter of the same size may be used instead of the former, the wound is bound up with lint, or a compress, dipped in cold water, applied, and it usually heals quickly. For the purpose of getting rid of the existing stricture, catheters of large size must soon be resorted to, but there must not be too much haste, especially before the wound has healed. On the other hand, should there be inflammatory symptoms present, the introduction of the catheter must be stayed, in order not to increase the irritation. The wound in the *perinæum* keeps open by the escape of the urine, and suppurates more or less. Afterwards, the above treatment must be employed (1).

Jameson's (*b*) treatment also resembles this.

Lallemand and Begin (*c*) object to this operation the difficulty of finding with certainty and cutting through the *urethra* behind the bulb, especially in fat persons; and the uncertainty of the true condition of the canal of the *urethra,* and of the point behind which it must be opened.

[(1) I leave Eckström's description of the mode of cutting into the *perinæum* for retention of urine, just as Chelius has given it, for it cannot be better described, but I must deprive him of the credit of having proposed this mode of treatment. To my own knowledge, it has been for more than thirty years the common practice, excepting that a silver instead of an elastic catheter is first introduced down to the stricture as a guide, in St. Thomas's and Guy's Hospitals, and among the Surgeons brought up in those schools. In the many months which Eckström spent with us some twenty-five years since, he must have seen this very operation performed again and again in the

(*a*) Froriep's Notizen, vol. xviii. p. 155. 1827.

(*b*) Medical Recorder, vol. vii. p. 25, vol. xii. p. 329.—Leger ; Dissert. de Paracentesi Urethræ in Ischuria Perinæi. Paris, 1778.

(*c*) Above cited, p. 347.

precise way in which he describes it; and it was then so old, that no one, that I am aware, laid any particular claim to the discovery of it. He must not, therefore, run away with the credit of having proposed not only the best, but the only operation for retention of urine which ought to be performed, with the single exception of retention from enlarged prostate, in which, if an operation for retention be ever required, that above the *pubes* must be performed.—J. F. S.]

Of the Catheter and its Introduction.

1814. The catheter is a cylindrical tube of different thickness, straightness and curve, corresponding to the extent and curve of the *urethra*. It may be either firm or flexible; in the former case it is best to be made of silver, and in the latter, of elastic gum or caoutchouc. The length of the catheter is different; for adult women six, and for young females five inches is sufficient; for adult men from ten to eleven, and the several periods of boyhood from five to seven inches. The thickness also varies; for women two lines, for girls a line and a half, for men two and a half lines, and for younger males a line and a half. The front third of a small catheter is slightly curved, and corresponds to the segment of a circle of which the diameter is six inches (1); the other parts of the catheter are straight, and its upper end is provided with a ring on each side. The female catheter is only slightly curved at its front extremity. The front end of the instrument is rounded, and has on either side a pretty large and well rounded hole. The walls of the catheter should not be very thin, and its surface should be well smoothed and polished (2). All catheters should be furnished with a stilette fitting into their cavity, and in elastic catheters it is best that this should be made of iron.

A large catheter is in general more easy of introduction than a small one, because it properly distends the walls of the *urethra*, and is not so easily caught in its folds as a smaller one. In cases, however, where considerable obstruction has to be overcome, as in stricture, a small catheter is passed more easily. One oval opening on the side of the front end of the instrument is better than several smaller ones, or than two on opposite sides; the little holes being easily stopped up in the former, whilst in the latter the necessary strength of the instrument is interfered with. The practice of closing the open end of the catheter with a round plug attached to the stilette is unnecessary. The curve, already directed, of the front third of the instrument, is the most proper; the Surgeon must, however, be provided with catheters of different curves, which are often necessary on account of the particular seat of the obstacle. Elastic silver catheters are useless.

Elastic catheters, with a permanent curve, so that they can be introduced without a stilette, are in many instances advisable.

The double **S** (shaped) curved catheter of PETIT is of no value.

BERTON (*a*) recommends the use of catheters, one having a curve at an inch, and another at an inch and a half from its tip, so that the lengthening of the axis of the body of the instrument makes, with the prolonged axis of its vesical extremity, an angle, in the former of from 9° to 10°, and in the latter of from 14° to 15°. These curves do not exceed the smallest diameter of the *urethra*, which varies between three and four lines.

Straight catheters were already known to the ancients, as proved by those which have been dug up at Pompeii; they were but very little curved (*b*).

PARÉ, also the two FABRICIUS, RAMEAU, SIETAUD, SANTARELLI, and CASSUS used straight catheters for men. GRUITHUISEN recommended, in 1812, straight sounds in his proposals for crushing stones; but of late they have been more particularly advised by CIVIALE and AMUSSAT. It is therefore remarkable that FOURNIER (*c*) should have claimed the priority of discovery of straight sounds, because he has used them since 1815.

(*a*) Archives Générales de Médecine, vol. xi. p. 66. 1826, May.

(*b*) CASSUS, Méd. Opérat., vol. i. pl. iii. f. 1.

(*c*) De l'Emploi de Lithotritie, Sondes droites, etc. Paris, 1829.

[(1) I prefer the catheter with a very open curve, indeed with the point thrown out rather beyond the quadrant of the circle, as recommended by Chelius, so as to form with the stem, a curve represented by the long quadrant of an oval, of which the long diameter is double that of the short one. Most Surgeons have a peculiar curve of their own, and those who have much practice in passing a catheter, soon find out that with which they are most dexterous.

(2) The thickness of the walls of the catheter is a matter of great importance, because unless sufficiently stout they are continually broken in the Surgeon's alteration of the curve to suit the particular case which is often requisite; and because, in passing the instrument, if it meet with much obstacle it is liable to be broken in the *urethra*, or even in the bladder. Catheters, as commonly made, are far too slight.—J. F. S.]

1815. The *introduction of a catheter* (*Catheterismus*, Lat.; *Einführung des Katheters*, Germ.; *Cathétérisme*, Fr.) is an operation requiring dexterity and practice, and is not unfrequently accompanied with very great difficulty. It is best divided into three stages. In the *first stage*, the catheter passes through that part of the *urethra* contained in the spongy body. The Surgeon grasps the *penis* behind the *glans*, with the thumb and forefinger of the left hand, without compressing the *urethra*. With the thumb, the fore and middle finger of the right hand he holds the upper end of the catheter smeared with oil or lard, and introduces its point, whilst the handle is towards the navel, into the opening of the *urethra*, and then drawing the *penis* up with the left hand, he pushes the catheter down towards the *perinæum*. In the *second stage*, in which the instrument passes through the membranous part of the *urethra*, when the beak of the catheter has got beneath the arch of the *pubes*, the *penis* is let go, and the handle of the instrument being sunk slowly, and *but a little*, the catheter is now again pushed somewhat forwards, and in the *third stage*, when the beak of the instrument has reached the neck of the bladder, is the inclination towards the thighs first increased, and the catheter pushed slowly forwards into the bladder. When the beak has entered the orifice of the bladder, the handle of the catheter is at last sunk completely between the thighs. It is most convenient for the patient to lie on his back during the introduction of the catheter, but he may either sit or stand; and, not unfrequently, it is more readily passed in one posture than the other. The elastic catheter, properly curved, may be used either with or without the iron stilette.

In the so called *tour de maître*, the handle of the catheter is held towards the thighs, and with its convexity upwards, introduced into the *urethra*. When the beak has reached the *pubes*, the handle is carried round towards the navel with a half turn, and then sunk. This handling is objectionable. In very stout persons the catheter must, at first, be introduced somewhat on one side.

[For other observations in regard to passing the catheter, refer back to *par.* 1807 and *par.* 1811, and their notes.—J. F. S.]

1816. The *introduction of the straight catheter* requires the same three stages as have been just described. The patient must kneel on the edge of the bed, with his thighs widely separated, and with the upper part of the body bent forwards, or he may stand or sit upon the edge of a stool in the same posture. The operator sits or kneels before him, and resting his left elbow upon the knee of the same side, grasps both sides of the *penis* with his left hand supine, draws it towards him horizontally and introduces with the right hand a straight catheter of proper size, carrying it with a drilling motion directly horizontal till it reach the arch of the *pubes*; he then draws the *penis* still more forwards, and sinks it together with the catheter, till it has made a right angle without inclining it towards the *perinæum*. The patient then bows himself considerably forwards, so that the *urethra* and neck of the bladder are brought into a line, and the catheter instead of following the upper wall of the *urethra* slips into the bladder.—(MOULIN) (*a*).

According to AMUSSAT's plan (*b*), the Surgeon, standing on the right side or between the legs of the patient sitting on the edge of a bed, with his feet on two chairs, draws the *penis* down with the left hand, till it be parallel with the thighs, introduces the straight catheter with the right hand into the *urethra*, and readily up to the pubic arch; he then draws the *penis* still more down, and holds the beak of the catheter directed upwards, which readily passes through the membranous part to the prostate. If the prostate be healthy, the hand only is usually sunk a little more, and the point of the instrument directed upwards to reach the bladder. If on the other hand the prostate be diseased, the operation is more difficult, and no positive rules can be given. It, however, seems in general to be more advisable not to sink the hand till the instrument reach about the middle of the prostate; the point of the instrument also must be endeavoured to be carried on upon the upper wall of the *urethra*.—(CIVIALE.)

1817. The introduction of the catheter must always be performed with the greatest caution and tenderness; violence may cause severe inflammation, tearing the *urethra*, false passages, and great bleeding.

The obstacles to the passage of the instrument are very various. If the handle of the instrument be sunk too quickly, its beak strikes against the pubic bones, and a firm resistance is felt: it must then be drawn back, and introduced rather deeper before the handle is again sunk. In difficult cases, it may be ascertained by the finger passed into the *rectum*, whether the catheter be beneath the pubic bones. If the instrument be introduced too low, or its beak be found in a wrong direction, when it either pushes the membranous part into a blind sac, or thrusts against a fold of the internal membrane of the *urethra*, it must be drawn a little back, the ring on the right side of the handle attentively observed, and the catheter pushed forwards in the proper direction. The forefinger of the left hand passed up the *rectum* can sustain the proper direction of the instrument. The entrance of the catheter is often opposed by spasm, or by swelling of the prostate. In the former case the catheter is to be held quietly, the *perinæum* rubbed, and then the instrument pressed forward in the proper direction. In swelling of the prostate, the method to be adopted has been already described (*par.* 1807.) Elastic catheters, when stopped by any obstacle, will often pass, if the iron stilette be withdrawn about an inch, and the catheter then pushed forwards. In strictures of the *urethra*, a catheter may sometimes be passed, if a bougie have been previously introduced, and allowed to remain some hours. In difficult cases catheters of different sizes must be used.

1818. When the catheter has entered the bladder it is known by its free motion, by the direction of its handle, which sinks between the thighs, and by the flow of the urine, when the stilette is withdrawn. If the flow be prevented by thick *mucus* or clots of blood, which get into the holes or into the canal of the instrument, the obstacle must be removed by injecting lukewarm water, or by introducing the stilette, or the water must be drawn off by a syringe attached to the outer end of the catheter.

In paralytic retention, pressure upon the lower part of the belly is often necessary to empty the bladder completely.

If there be much difficulty in introducing the catheter, it is best to let it remain; its aperture may be plugged, and it may be fastened by a

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(*a*) Nouveau Traitement des Rétentions d'Urine et des Rétrécissemens de l'Urètre par le Cathétérisme rectiligne, etc. Paris, 1834.

(*b*) P. EGOT, Dissert. du Cathétérisme exercé avec la Sonde droite. Strasb., 1825. 4to.

double bandage and circles of sticking plaster around the *penis.* The urine must be allowed to escape every three or four hours; and every six or seven days a fresh one introduced, so that it may not get too much softened and encrusted. If the patient cannot bear the inlying of the catheter, it must be introduced as often as needful.

If a stiff elastic or silver catheter remain in very long, or if the *urethra* be shorter than usual, its beak may gradually penetrate the hinder upper wall of the bladder, and cause fatal *peritonitis.* In this case the urine begins to escape after five or six days, or it escapes between the *urethra* and catheter, and symptoms of *peritonitis* arise. To prevent this the catheter must be carefully fastened, not too closely, so that it do not penetrate more deeply than that the urine may escape by its side openings. This may be easily managed, if whilst the urine flows, the catheter be pushed a few lines in, and carefully fastened at the moment it ceases to flow.—(LALLEMAND) (*a*).

1819. The *introduction of the catheter in the female* is much more easy than in the male. The patient being laid on her back, and her thighs somewhat separated, the forefinger of the right hand, with the catheter upon its volar surface, is passed between the *labia* towards the orifice of the *urethra*, which is distinctly felt with its tip as an aperture surrounded with a little puffy edge, and into it the catheter is passed. If it cannot be managed in this way, the parts must be exposed so that the orifice of the *urethra* may be brought into view.

OF PUNCTURING THE BLADDER.

1820. When in consequence of retention of urine, the bladder is so greatly distended, that dangerous results, as mortification, tearing of the bladder, or extravasation of urine, are to be dreaded, and the voidance of the urine cannot be effected by the natural passage, there remains no other means of safety for the patient than emptying the bladder by artificial means, or *puncturing the bladder*, (*Paracentesis Vesicæ*, Lat.; *Blasenstich*, Germ.; *Ponction de la Vessie*, Fr.,) as it is called. This operation is rarely necessary, if the introduction of wax or catgut bougies, elastic catheters, and a mode of treatment corresponding to the character of the retention, have been carefully pursued. It is, however, bad practice to dispense with this operation, by trusting to the violent introduction of the catheter, in cases of insurmountable obstacles in the *urethra.* Puncturing the bladder is not so dangerous an operation as by many supposed; its danger is only much increased when it has been too long delayed.

1821. Puncture of the bladder may be performed in three ways: *first*, above the *pubes; second*, through the *rectum*, and in women, through the *vagina; third*, through the *perinæum.*

1822. In *puncturing the bladder above the pubes*, the patient must be placed in a half sitting posture in bed. The hair of the *pubes* having been removed, an assistant fixes the bladder with both hands, and holds it in the mesial line, corresponding to the *linea alba.* The Surgeon puts the nail of the forefinger of his left hand upon the upper edge of the pubic *symphysis;* holds with the whole right hand a somewhat curved (FLURANT'S) trocar, lays his forefinger on its convex surface, and places it with the concavity downwards, close above the nail of the left hand upon the white line, and thrusts it through the walls of the belly into the bladder. When the trocar has penetrated from two and a half to four inches deep, according to the thickness of the walls, the operator grasps the tube

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(*a*) Perforation de la Vessie par les Sondes fixés; in Révue Médicale, vol.ix., p 299. 1822, Nov.

with the fingers of the left hand, and draws the stilette out with the right. The urine now escapes by the tube, and being assisted by pressure on the belly, is gradually discharged. In order to prevent the sharp edge of the instrument injuring or irritating the walls of the bladder as it contracts, another silver tube with a blunt end is to be introduced through it, through the side openings of which the urine can escape ; its other end is furnished with a stay (*a*). For fixing the inner tube, a cleft compress is to be so applied, that the tube may lie in its cleft. The vertical part of a T bandage is to be crossed before and behind the tube and fastened to the girdle part. The outer tube must be fixed by bandages, drawn through the openings in its outer end, to the girdle-piece of a T bandage. To prevent the inner tube drawing back, tapes must be introduced through its rings, and attached to the openings of the outer tube.

The direction to thrust in the trocar an inch to an inch and a half above the pubic *symphysis* rests on the notion that the bladder, in its ascent above the *symphysis*, is separated from the hind wall of the belly. However, in puncturing high, the danger of wounding the *peritonæum* is greater, and the bladder may more easily slip away, when it contracts, after the urine has been voided. In very stout persons, if the bladder be not very full, it may be proper to make a previous cut of an inch and a half long through the coverings in the same place above the pubic *symphysis*, in the white line, till the bladder can be distinctly felt with the finger.

The curve of the trocar should be a segment of a circle of eight inches diameter (DESAULT) ; its length must vary according to the bulk of the body, but should not be less than five inches.

It is objectionable to introduce a second tube, with a rounded end, or a flexible catheter, through the first, and to withdraw it, as the urine will escape by the side of the smaller tube.

1823. After the operation, the urine must be discharged by the tube as often as is necessary. If inflammatory symptoms arise or continue, corresponding remedies must be employed. Towards the seventh day, the tubes must be removed to be cleaned. The inner tube must be first withdrawn, and then a curved steel cylinder having been introduced into the bladder, through the canula of the trocar, the canula must be drawn over it, and after having been cleansed, must be returned upon it.

During the after-treatment, attempts must be made in every possible way to restore the natural passage for the urine. When this can be effected, and a flexible catheter have been introduced into the bladder, the tube may be withdrawn ; and then, whilst the surrounding coverings are held back with one hand, the opening is to be covered with sticking plaster, and if it will not close, must be frequently touched with lunar caustic.

In changing the tubes care is always necessary for a long while, because the union of the bladder with the hind surface of the abdominal muscles is frequently not sufficiently firm for a considerable time. A previous cut through the covering prevents this adhesion. When, therefore, the reopening of the natural passage is impossible, the trocar must be thrust directly through the coverings, the tubes safely fastened, and the urine discharged less frequently through the tube, which must not be changed before the eighth day, and then only with the greatest care, the patient kept quiet, and when union between the bladder and abdominal muscles has taken place, an elastic catheter may be introduced into the bladder. SCHREGER (*b*) proposes, by means of loops introduced into the walls of the bladder, by the sides of the trocar tube, to bring them into contact with the walls of the belly, and encourage their union.

(*a*) ZANG, Operationen, vol. iii. pt. ii. pl. i. The same mode of proceeding, though with a different object, is directed by DESCHAMPS, Traité historique et dogmatique de la Taille, vol. iv. pl. viii.

(*b*) Above cited, p. 231.

Upon puncturing the bladder above the pubic *symphysis*, the following works may be consulted:—

Méry; in Histoire de l'Académie des Sciences. 1701, p. 378.

Bonn, above cited.

Mursinna, Neue medic.-chirurg. Beobachtungen, p. 391. Berlin, 1796.

Palletta, Della Punctura della Vesica orinaria; in Giorn. di Venezio, vol. ix. p. 217.

Desault, Œuvres Chirurgicales, vol. iii. p. 317.

Meyer, Dissert. de Paracentesi Vesicæ. Urlang., 1798. 4to.

Soemmering, above cited, p. 52.

Schreger; in his Chirurgischen Versuchen, vol. i. p. 211.

Abernethy, Surgical Works, vol. ii. p. 189.

Kothe, Würdigung der Methoden des Harnblasenstiches; in Rust's Magazin, vol. xvii. p. 281.

1824. In *puncturing the bladder through the rectum*, after having cleared the *rectum* with a clyster, the patient must be laid on the edge of a bed, so that the depending thighs may be bent and supported apart by assistants. The Surgeon introduces his finger oiled into the *rectum*, about six lines above the prostate gland; then carries the curved trocar, with its point retracted, upon it, to the part where the finger determines the puncture should be made. The handle of the trocar is now sunk against the buttock, and at the same time the point thrust forwards out of the canula, and the trocar pushed in the axis of the *pelvis* to the depth of an inch to an inch and a half. The stilette is then withdrawn, whilst the left hand steadies the tube. The urine having flowed through the first tube, a second, with a rounded end, is introduced, and both fixed by means of a cleft compress and T bandage, and tapes drawn through the rings.

The works which may be consulted on puncture through the RECTUM are

Pouteau, Mélanges de Chirurgie, p. 500. Lyons, 1760.

Hamilton; in Philosoph. Trans., vol. xvi.

Reid, A., An Enquiry into the merits of the Operations used in Obstinate Suppressions of Urine. London, 1778. 8vo.

Klosse, Dissert. de Paracentesi Vesicæ urina per intestinum rectum. Jena, 1791. 8vo.

Home, Everard; in Trans. of a Society for the Improvement of Medical and Surgical Knowledge; and in Practical Observations on the Treatment of Strictures in the Urethra and the Œsophagus, vol. ii. p. 329. Second Edition.

Carpue, History of the High Operation for the Stone, p. 176. London, 1819. 8vo.

1825. *Puncturing the bladder through the perinæum*, is the most ancient practice, but at present almost entirely given up. In this operation, either the *urethra* and neck of the bladder are opened directly by a cut in the *perinæum* or the cut is made upon a staff, (*boutonnière*,) into the neck of the bladder, or the bladder is pierced with a trocar, which is thrust in either *directly* in the middle of a line supposed to be drawn from the ischial tuberosities to the *raphe*, two lines in front of the edge of the *anus*, the point of the instrument being directed first parallel to the axis of the body, and then thrust somewhat inwards; or a cut an inch and a half long is made half an inch to the left side of the *raphe*, beginning beneath the bulb of the *urethra*, and ending by the verge of the *anus*, through the cellular tissue and muscles; whilst an assistant presses the bladder down, the operator's forefinger of the left hand introduced into the wound, ascertains its position, and then upon it he carries a thick grooved trocar, directed somewhat upwards into the bladder. The urine having been discharged, the outer wound is lightly filled with lint, the tube plugged and fastened as in puncture through the *rectum*.

For a careful recital of the various methods of proceeding in puncturing the bladder through the *perinæum*, see

Poller, Ueber den Harnblasenstich im Damme. Erlang., 1813. 8vo.

Upon the various modes of using the Sound, see

Desault, above cited, vol. iii. p. 320.

1826. Although opinions agree upon the undoubted preference of puncturing the bladder above the pubic *symphysis*, and through the *rectum*, to that through the *perinæum*, yet do they differ in regard to the first two modes of operation.

In regard to puncture above the *pubes*, it is considered as easily performed and slightly painful; that by it merely the coverings of the belly and one part of the bladder are injured, where it usually is not inflamed, and where it can be best treated; that the bladder cannot be missed, that the after-treatment is easier, extravasation of urine does not so readily occur, and the tubes, if they accidentally fall out, can be easily replaced, and may be changed and cleaned with little trouble; and that the patient can go about whilst they remain in. On the other hand, the slipping off of the bladder from the tubes after the discharge of the urine, by its falling together, and by the pressure on it, if it descend very low, inflammation and suppuration of the hind wall of the bladder, and thrusting the tube into the *rectum*, are to be dreaded; also if the urine be not completely discharged, that a part of it always remains in the bottom of the bladder.

For the preference of puncturing through the *rectum*, it is alleged that the walls of the bladder and *rectum* are in closer contact, that the trocar has no thick parts to penetrate, and therefore the operation is not painful; that the swelling of the bladder is more perceptible, and failure in introducing the trocar less possible. On the contrary, it is thought that in this operation the bladder may be missed, a blood vessel, or the seminal vesicles, or the *peritonæum* wounded; that its effects are always greater, the escape of the tubes, infiltration of the urine, collection of pus and consequent urinary *fistula*, are to be feared.

1827. The objections to the puncture above the *pubes* are of little value, as in performing it with a curved trocar, and by the introduction of a blunt tube, no injury to the hind wall of the bladder can ensue, and the escape of the urine can be furthered by the proper position of the patient. This mode of operation, therefore, serves generally, but is especially preferable over that through the *rectum* in those cases where the bladder is inflamed or otherwise diseased, in hardening of the prostate, in diseases of the *rectum*, specially in hæmorrhoidal swellings, and if the discharge of the urine through the operation-wound must be long sustained, or throughout life.

As to the objections made to puncturing through the *rectum*, it may be replied, that the injury of the seminal vesicles may be easily avoided by passing the finger in deeply, and thrusting the trocar directly into the middle of the swelling; that wounding the *peritonæum* is not easily possible, because in the elevation of the bladder, the space between the prostate and that membrane is increased; and the slipping out of the tubes, in many cases, cannot produce any inconvenience, as the urine either flows out through the opening, or the bladder again fills. The preference, however, of the puncture above the *pubes* always continues the greatest. As peculiar indications for puncturing through the *rectum* may be held, a very deep-seated bladder, effusion of blood into it, and an overweening dread of the patient about an operation, in which case it can be done through the *rectum*, without his knowledge.

Poller (*a*), in cases where the operation above the *pubes* cannot be performed, prefers that through the *perinæum* to the puncture through the *rectum*, especially if it be foreseen that the retention of urine may be continued a long time after the operation. In the puncture through the *perinæum*, there are also some special objects attainable, as the emptying calcareous concretions in permanent disposition to form stone, and the removal of the danger of ischury in consequence of large stones, which cannot be removed.

[But few Surgeons in England, I believe, at the present time, ever perform either of the operations for puncturing the bladder, as above described, except in the single case of enlarged prostate, in which the operation above the *pubes* should be performed; and indeed, as regards that disease, the necessity for any artificial assistance, beyond that of introducing a catheter, is so rare, that it is scarcely thought of. In all cases the operation of opening the membranous part of the *urethra*, and introducing a catheter into the bladder, which is, and has been for many years past, commonly practised in this country, is the most satisfactory and the most effectual. If there be stricture, it is the Surgeon's fault if the stricture and the retention be not cured at one and the same time; and, to a certainty, it prevents the possibility of mischief from extravasation, as the urine speedily flows by the wound, and is never pent up. There is neither difficulty nor danger in this operation. With common attention, the *urethra* may, in most cases, be found, and a catheter at once passed into the bladder. If it cannot be found, as occasionally happens with young operators, who cut right through the *urethra* before they are aware of it, if the cut be continued more deeply, the bladder must be opened, if the wound be carried up in the axis of the *pelvis;* and if it be not opened, it is not matter of great consequence, provided there be a free external opening, as in the course of a few hours the urine will find its way into the wound, and be readily discharged; and in cases of stricture, if the stricture be so far forward that it be not involved in the wound in the *perinæum*, made by the knife, or by sloughing, if urine be extravasated, it generally relaxes so much, that it can be cured by the ordinary treatment with bougies, or sounds, during the reparation of the wound in the *perinæum.*—J. F. S.]

IV.—OF THE CÆSAREAN OPERATION.

(*Sectio Cæsarea*, *Gastrohysterotomia*, *Laparo-Metrotomia*, Lat.; *Kaiserschnitt*, Germ.; *Opération Césarienne*, Fr.)

Rousset, Traité nouveau de l'Hysterotomokia, Paris, 1581. Translated also into Latin by Bauhinus. Basil, 1582.

Ruleau, Traité de l'Opération Césarienne. Paris, 1704.

Simon, Recherches sur l'Opération Césarienne; in Mém. de l'Acad. de Chirurg., vol. i. p. 623; vol. ii. p. 308.

Kaltschmidt, De Partu Cæsareo. Jen., 1750.

Stein, G. W., Praktische Anleitung zur Kaisergeburt. Cassel, 1775.

Weissenborn, Observations duæ de Partu Cæsareo. Erford., 1792.

Freymann, De Partu Cæsareo. Marb., 1797.

Hull, John, M.D., A Defence of the Cæsarean Operation, &c. Manchester, 1798. 8vo.

Gaillardot, C., Sur l'Opération Césarienne. Strasb., 1799.

Stein, G. W., Geburtshülfliche Abhandlungen. Part I. Marb., 1803.

Ansiaux, N., Dissert. sur l'Opération Césarienne et la Section de la Symphyse des Pubis. Paris, 1803.

Nettmann, J. F., Speciem sistens Sectionis Cæsareæ Historiam. Hall, 1805.

Graefe, C. F., Ueber Minderung der Gefahr beim Kaiserschnitte nebst der Geschichte eines Falles, in welchem Mutter und Kind erhalten wurden; in Journal für Chirurgie und Augenheilk., vol. ix. p. 1.

Michaelis, G. A., Vierter Kaiserschnitt der Frau Adametz, mit glücklichem Erfolge für Mutter und Kind; in Neue Zeitschr. für Geburtskunde, vol. v. p. 1. Berlin, 1837.

Kayser, C., De eventu Sectionis Cæsareæ. Havniæ, 1841. 8vo.

Rigby, Edw., M.D., A System of Midwifery. London, 1844. 12mo.

(*a*) Above cited, p. 47.—Mondière; in Révue Médicale, vol. ii. p. 319. 1841.

1828. When the *pelvis* is so narrow that a child cannot be brought into the world at all by the natural passages, or not alive, the delivery must be effected by some other than the natural way, that is, by the artificial opening of the belly and womb.

1829. The circumstances demanding the Cæsarean operation are *first*, when the antero-posterior diameter of the outlet of the *pelvis* is less than two and a half inches, and the child is alive; *second*, when there is so great narrowing of the *pelvis*, that the dismemberment of the child is impossible.

When it is not quite certain that the child is alive, perforation should be preferred to the Cæsarean operation; as it should be also in misformed children. If the mother be against the operation, her voice must be attended to. In doubtful cases, for instance, when the signs which declare for and against the life of the child are of equal value, the choice of the operation is not to be left to her decision, if she resolve upon it during the labour.

[" The difficulty of deciding upon the operation, according to the indications of the Continental practitioners, is," observes RIGBY, " much more perplexing than according to that which is followed in this country. The question here is, can the child, under any circumstances, be made to pass *per vias naturales* with safety to the mother? The impossibility of effecting this object is the sole guide for our decision. In using the operation as a means for preserving also the life of the child, we must not only feel certain that the child *is* alive, but that it is also capable of supporting life, before we can conscientiously undertake the operation upon such indications. This uncertainty as to the life or death of the child greatly increases the difficulty of deciding. Under circumstances where there is reason to believe that, although the child may be alive, it is, nevertheless, unable to prolong its existence for any time, and the *pelvis* so narrow that it can only be brought through the natural passage piecemeal, we are certainly not authorized in putting an adult and otherwise healthy mother into such imminent danger of her life, for the sake of a child which is too weak to support existence. Circumstances may, nevertheless, occur, where the *pelvis* is so narrow that the child cannot be brought even piecemeal through the natural passage; in this case, even if the child be dead, the operation becomes unavoidable. Under the above-mentioned circumstances, it is the duty of the Surgeon to perform the operation; and he can do it with the more confidence, from the knowledge of many cases upon record, where it has succeeded, even under very unfavourable circumtances, and where it has been performed very awkwardly; moreover, it seems highly probable, that the unfavourable results of this operation cannot often be attributed to the operation itself, but to other circumstances. Not, unfrequently, the *uterus* has been so bruised, irritated and injured, by the violent and repeated attempts to deliver, by turning or the forceps, and the patient so exhausted, and brought into such a spasmodic and feverish state, by the fruitless pains and vehement efforts, together with the anxiety and restlessness which must occur under such circumstances, that it is impossible for the operation to prove successful." (pp. 154, 55.)]

1830. In a pregnant woman just dead, the Cæsarean operation should be performed, if pregnancy be so far advanced, that the child is capable of living, if the delivery be not possible by the natural passages, and the mother *actually*, not *apparently*, dead (*a*); in which case the operation must be undertaken as quickly as possible.

[The importance of the actual death of the mother being put, beyond all doubt, previous to undertaking the operation, under these circumstances, cannot be too strongly impressed. A medical friend, on whose veracity I can rely, told me of an instance in which a practitioner in the country, presuming that a pregnant woman labouring under typhus fever was dead, began the performance of the Cæsarean operation, the pain of which arousing her from her deathlike state, she screamed out, and soon died. He lost his practice, and was obliged to leave the place.—J. F. S.]

1831. The Cæsarean operation, partly on account of the very large wound it inflicts, partly on account of the symptoms which follow after, is a most exceedingly dangerous operation. The number of patients

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(*a*) RIGAUDEAUX; in Journal des Sçavans, 1749.

saved is very few, in comparison with those who have died after it. Cases, however, are mentioned, where the operation has been performed, two, five, six, and seven times, upon the same person (*a*). A more favourable result is to be expected, if the patient's health be good; if she have not suffered from previous disease, fruitless labour-pains, or artificial attempts at delivery, and if the operation be undertaken at the right time.

[MICHAELIS, who has very carefully inquired into the subject, has considerable doubts of the authenticity of many of the cases of repeated Cæsarean operation on the same woman, which have been related by the writers of the seventeenth and eighteenth centuries; for, as he observes, "it must be considered remarkable that no writer, as it seems, relates the circumstance at first hand, that is, from the Surgeon himself; for in No. 3, (the woman who stated she had been operated on thrice,) No. 7, (the ship's captain who declared himself the sixth son of whom his mother had been delivered by this operation, and that she died in her seventh pregnancy, because the Surgeon who had previously operated on her was deceased,) No. 8, (the Minorite, the fifth son of another in this same way delivered of all her children,) and No. 9, (the woman mentioned by COUNT TRESSAN, who had been delivered by the Cæsarean operation seven times,) the woman, or the sons who related it, are not of sufficient credit. To this must be added, that some of these histories rest alone upon hearsay, or on suspicious witnesses. Thus was it, for instance, with COUNT TRESSAN's case, at a time when, at least in France, literary intercourse was very active, that it seems incomprehensible how BAUDELOCQUE, in the *Recueil périodique de la Soc. de Méd.*, vol. v. p. 63 to 74, in which he gives a collection of sixty-six cases, from the year 1752 to 1799, should never at all have thought of this most remarkable case of all; and it is almost beyond belief, that it should remain for COUNT TRESSAN to discover such a case." (p. 5.) "This inquiry, therefore, leads to the single result, that the old cases of often-repeated Cæsarean operation must at least remain very doubtful. If, however, we be disposed to give credit one way or other, yet there is little benefit to knowledge from the want of old precise *data*, as, on the whole, the case of ADAMETZ alone shows the possibility of an often repetition of the operation." (p. 6.)]

The most satisfactory inquiry into the result of the Cæsarean operation is that made by KAYSER (*b*), who divides the history into two periods; the former terminating with SIMON's Essay in 1749, and the latter from 1750 to the publication of his own paper. Of the two hundred and fifty-eight cases collected in the first period by MICHAELIS, to some of which reference has been already made, several rest on very slender authority. Of the three hundred and thirty-eight cases in the second period, one hundred and twenty-eight had a fortunate result, as regarded the life of the mother; whilst two hundred and ten terminated fatally; or a mortality of 62 per cent. It appears, however, from the following table, that the fatality of the operation has been diminishing since 1750:—

From 1750 to 1800 there were	37 successful	80 fatal cases.
„ 1801 „ 1832 „	54 „	94 „
„ 1833 „ 1839 „	37 „	36 „
	128	210

Or in a decreasing ratio of 68, 63, and 49 *per cent.*

Where labour had lasted more than seventy-two hours, the mortality was 72 *per cent.*; in those where it had continued a less time, only 61 *per cent.*

According to KAYSER's inquiries, it appears, that "in one hundred and twenty-three cases the cause of death was stated with more or less accuracy; and it appears that seventy-three women died from inflammation, or its consequences, and twenty-nine from the shock to the nervous system. Internal hæmorrhage occurred in ten, in whom *coagula* of blood were found in the *abdomen*; two died from external hæmorrhage, two

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(*a*) SIMON; above cited, p. 636.—LE MAISTRE; in Journ. de Médec., vol. xliv. 1812.—SOMMER; in Russischen Sammlungen für Naturwissenschaft und Heilkunst, vol. i. pt. iv. Leipz., 1817.—LOCHER, J. T., M.D.; in Med.-Chir. Trans., vol. ix–xi. p. 182.

(*b*) Cited at the head of the article. I am very sorry that I have been unable to lay hand on this Inaugural Essay; and am, therefore, compelled to refer to the very meagre extracts from it in the British and Foreign Medical Review, vol. xiv. p. 199, 1842, in which the reviewer observes:—"It is true that this task (that of presenting a list as complete as possible of all well-authenticated cases) is by no means new, but it has never been executed so well as by KAYSER." I hope, however, at a future occasion to be more successful.—J.F.S.

from *pneumonia*, one from rupture of the *uterus*, and consequent hæmorrhage, on the seventh day after delivery; one died from *osteomalacia*, and one from the immediate effects of the operation, only twenty-four hours after its completion." (p. 129.)

Michaelis's own case is the most remarkable and best authenticated of any that have been published. The woman was delivered four times by the Cæsarean operation. The account of the first three is given by Feist (*a*), and of the fourth by Michaelis himself (*b*).

The woman was born at Wilster, in Holstein, in 1795, and was so ricketty that she was only able to walk a little when in her twelfth year. She became pregnant, and on the morning of the 18th June, 1826, all other means of delivery being inefficient, the Cæsarean operation was performed by Dr. Zwanck, of Eddelack. The *placenta* was separated and removed immediately after the child, which appeared to have been some time dead, had been extracted, the womb contracting strongly; but this was followed by a severe bleeding, which was stopped by dropping cold water from a sponge, at a height of some feet. The edges of the external wound fell so completely together that there was not need of sutures, and sticking plaster was alone applied. Shortly after three weeks it had healed; before a month she left her bed, and two months from the operation menstruated. On the 21st Jan., 1829, she was again in labour, at the Lying-in Hospital at Kiel, where the Cæsarean operation was performed on her by Wiedemann: the child was born alive. The external wound was brought together with three stitches and sticking plaster, and a small tent left in the lower angle of the wound. On the 21st Feb. she got up from her bed for some hours, and was very well. In the beginning of March the wound was perfectly healed, except a few points of skin and a small sinus, which had not healed when she left the house at the latter end of that month. On the 28th March, 1832, she was in Kiel Lying-in Hospital, again subjected to the Cæsarean operation, which was performed by Michaelis, and the child born alive. The womb contracted imperfectly on the removal of the after-birth, and there was then first a slight flow of blood from the womb, which was stopped in a few minutes by a stream of water from a sponge. Four sutures were put into the skin-wound, with a small portion of linen into its lower angle, and sticking plaster afterwards applied with a circular roller. The wound was healed, excepting a very small part of the scar, by the 16th May; but on the 25th, a small fistulous passage was discovered running into the womb, which had become firmly adherent to the walls of the belly. On the 10th June the fistula was healed (*c*).]

1832. The favourable time for this operation is that at which nature would, under other circumstances, expel the *fœtus*; when, for instance, *mucus*, streaked with blood, flows from the generative parts; when the mouth of the womb is wide open, the waters have escaped, the head or any other part of the child is perceptible, and the labouring woman has suffered already actual, painful, quickly following labour-pains, nearly approaching convulsions. (Graefe.)

["Although it is so important," says Rigby, "that we should lose no time, still, nevertheless, it does not appear desirable to operate before labour has commenced, to any extent; for, unless the *os uteri* has undergone a certain degree of dilatation, it will not afford a sufficiently free exit for *liquor amnii*, blood, *lochia*, which, by stagnating in the *uterus*, after the operation, would soon become irritating and putrid, in which case they would be apt to drain through the wound, and create much mischief." (p. 155.)]

1833. The preparation for the operation consists in emptying the *rectum* with clysters, and the bladder with a catheter. The instruments required for this operation are a convex-edged and a button-ended straight bistoury, a director, bandages, and several needles. The position of the patient should be horizontal, upon her back, with the upper part of her back somewhat raised, on a narrow table, covered with a mattress; she should also be covered with a cloth at those parts not

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(*a*) Neue Zeitsch. für Geburtskunde, vol. iii.

(*b*) Cited at head of article.

(*c*) Michaelis, G. A., M.D., Abhandlungen aus dem Gebiete der Geburtshülfe. Kiel, 1833, large 8vo.; with eight plates. Extracts from the same in Neue Zeitsch. für Geburtskunde, vol. iii. p. 438. By Feist of Mainz.

interfering with the operation, and should be held by assistants. Her face should be turned from the operator, or covered with a thin cloth.

1834. To prevent the protrusion of the intestines through the wound in the walls of the belly, moderate pressure with the hands is usually employed. Auterieth proposes the previous introduction of ligatures before the womb is opened, and Rietgen, a girdle of plaster. Graefe more properly makes well-regulated pressure with three sponges, each a foot long, six inches wide, and three inches thick, held by assistants, so that a space about eight inches long, and from three to four wide, is left clear. If intestines be found between the womb and the wall of the belly, which may be ascertained by the yielding elastic condition of the latter, they must be first thrust back by gentle pressure, till a convex, unyielding firm hard body be felt in every direction. At the very moment when the last part of the child escapes, the sponges must be more firmly pressed, by the assistants.

1835. The seat and direction of the cut has been variously proposed.

First. The *Lateral Cut*, on the side where there is the greatest prominence of the belly, or, directly opposite it (*a*), by the side of the white line, more or less distant from it, in or near the *m. rectus abdominis*, between the navel and the pubic bones, and a little obliquely from above downwards and outwards (*b*).

Second. The *Cut in the white line*, beginning from above or below the navel, to an inch and a half or two inches above the pubic *symphysis* (*c*).

Third. The *Transverse Cut*, upon the side, where the womb is most prominent between the *m. rectus* and the spinal column, and between the false ribs and the crest of the hip-bone, above or below the navel (*d*).

Fourth. The *Oblique* or *Diagonal Cut*, the direction of which is from the extremity of the lowest false rib to the horizontal branch of the pubic bone of the other side, obliquely across the white line, so that the middle of the cut falls immediately upon it (*e*).

1836. The choice and direction of the cut, with its accompanying advantages, are not in general determinate, but must be guided by the particular circumstances of the case, especially by the position and direction of the womb, the pretty well known seat of the *placenta*, the position of the child, the size of the space between the navel and the pubic *symphysis*, and the like. As the *placenta* is most usually on the right side, though it may be also on the left, preference has been given to the cut on the left side rather than to that on the white line. In this cut the outer and inner walls are parallel, all fluids escape more readily from the wound; the wall of the belly is at this part thinnest; in opening it no blood vessel is wounded, and the healing of the wound in the *linea alba* is as quick as in any other part of the wall of the belly. In the diagonal cut the womb, after the operation, contracts so that the wound in it does not gape. The same also happens with the oblique cut; in it, however, the wall of the belly is cut through at its thickest part, and vessels are wounded. That part is to be specially considered as the best where the womb and the child can be most distinctly felt.

1837. The operation consists of the following steps:—*first*, the opening

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(*a*) Millot, Observation sur l'Opération dite Césarienne, faite avec succès. Paris, 1796. Observations sur les Causes et les Accidens de plusieurs Accouchemens laborieux. Paris, 1750. 8vo. Second Edition.

(*b*) Rousset, above cited. — Levret, Observations sur les Causes et les Accidens de plusieurs Accouchemens laborieux. Nouv. Edit. Paris, 1780. 8vo.—Stein, Abhandlung von der Kaisergeburt.

(*c*) Guérin, Histoire de deux Opérations Césariennes. Paris, 1750.—Baudelocque, L'Art des Accouchemens, vol. ii. Paris, 1807.—Deleurye, Observations sur l'Opération Césarienne à la ligne blanche. Paris, 1788.

(*d*) Lauverjat, Nouvelle Méthode de pratiquer l'Opération Césarienne. Paris, 1788.

(*e*) Stein, Geburtshülfliche Abhandlungen, vol. i. p. 125.

of the belly-wall; *second*, the opening of the womb; *third*, the drawing forth of the child and of the after-birth; *fourth*, the closing of the wound.

1838. The skin and abdominal muscles are to be cut through to the *peritonæum* in one of the directions given, (*par.* 1835,) with a convex bistoury. Any vessel wounded must be tied; a small opening is then made into the *peritonæum* to admit the forefinger of the left hand, and upon it the button-ended bistoury is introduced and divides the *peritonæum* the whole length of the outer wound. A cut is then made in the white line, as no vessel can be there wounded, bearing in mind the thinness of the expanded wall of the belly, with one stroke through the coverings and *peritonæum.* A length of five inches for the cut in the wall of the belly is sufficient, and of four and a half inches for that in the womb is generally to be considered sufficient. The womb now presenting itself in the wound, of a bluish-red colour, its cavity is to be cut into with the convex bistoury to a small extent, and the wound enlarged in the direction of the outer wound, as quickly as possible with the button-ended bistoury introduced on the forefinger. The child, grasped according to its position, by the head or feet, is to be drawn out, but not too hastily, and the navel-string tied and divided. If the opening of the womb fall upon the middle of the *placenta* the cut must be quickly enlarged, the *placenta* cut through, the child pulled out, and the *placenta* separated. If the cut light upon the edge of the *placenta*, it must be separated. If the separated *placenta* present itself in the wound of the womb, it must be separated by a gentle pull upon the navel-string and by a not very quick twist. If this be not sufficient, it must be separated by introducing the hand into the womb.

WIGAND'S (*a*) proposal of pushing the navel-string with a curved rod through the mouth of the wound into the *vagina* is objectionable.

If the womb do not, by its own contraction, descend into the *pelvis*, it must be cautiously thrust down (*b*).

Various kinds of knives for the Cæsarean operation have been recommended by STEIN (*c*), by FLAMMAND, with a removable sheath (*d*), by ZELLER (*e*), and MESNARD'S knife and scissors (*f*).

1838. After the blood, which has escaped into the cavity of the womb, has been sopped up with fine sponge dipped in warm water, the membranes, which by stopping up the mouth of the womb prevent the flowing away of the blood, are to be removed, the blood poured into the belly gently pressed out, and any of the intestines which have protruded having been replaced, the edges of the wound are brought together by the assistants, and closed with the sutures (*g*), which are introduced with needles of sufficient breadth, in such way, however, that the lower angle of the wound, in which a strip of oiled linen is to be placed, may remain open for the escape of fluid. To support the closed wounds, some pieces of sticking plaster, from four to five inches and a half in width and length, are to be put on, and once and a half surround the belly, their middle placed on the back, and the ends brought forwards crossing in front upon the wound and fixed obliquely below. The open part of the wound below is to be covered with wadding spread with ointment, and over it sticking plaster, and the whole belly supported with a linen girdle, having

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(*a*) Drei Geburtshülfliche Abhandlungen, p. 96. Hamburg, 1812.

(*b*) Geburtshülfliche Abhandlungen.

(*c*) Anleitung zur Geburtshülfe, pl. vi. figs. 3, 4. Fifth Edition.

(*d*) Dissert. de l'Opération Césarienne. Paris, 1811.

(*e*) SCHNETTER'S Verzeichniss der chirurg. Instrumente.

(*f*) KROMBHOLZ'S Akologie, pl. v. fig. 30, pl. vi. fig 1844.

(*g*) GRAEFE, above cited, p. 25.

strings in front. The patient is then so placed in bed that the lower angle of the wound may, as far as possible, be the most depending part.

[In a case operated on by **Godefroy** of Mayence (*a*), after the womb had contracted the edges of the wound did not come together, but a considerable space remained between them; he therefore passed some sutures of waxed double threads, with a needle, through the whole thickness of the womb. The wound in the wall of the belly was also brought together by passing the needle through its whole thickness, and also through the *peritonæum.* On the eleventh day, the union of the wound appearing firm, the sutures were removed. On the twenty-ninth day no trace of suppuration remained, and the patient left her bed. She recovered, and her child had been saved. Objections have been made by **Desormeaux** to sewing up the womb, but **Godfroy** thinks their danger is exaggerated.

"The most dangerous circumstance in this (Cæsarean) operation is," observes **Michaelis**, "the impossibility of preventing completely the effusion of the secretion from the wound into the belly. The choice of the seat of the operation, as nearly as possible parallel to the white line, seems to be always the most important point, for there most rarely do the two wounds separate from each other. I have already mentioned, in another case (*b*), the remarkable circumstance that the wound in the womb lies transversely, and sinks to the lowest angle of the wound in the wall of the belly; and in other instances I have observed still more remarkable varieties in the wound and its fatal consequences. It may be hoped that this more frequent separation would not be so injurious, as the secretion of the wound discharges itself through the mouth of the womb and the *vagina.* The form which the wound assumes in consequence of the contraction of the womb is, however, unfavourable for this escape; it gapes externally, and lies close together within. Thus was it in my case, in which the whole wound in the womb remained long open, and was in general supported by purely mechanical means. But when the after-pains very soon subside the womb may so close, in consequence of general turgescence, before the oncoming of suppuration, that the cure is quick and without suppuration. It is therefore important that the after-pains should be very early put a stop to, if possible, by the moderate, or even the more active use of opium." (p. 24.)]

1840. The *after-treatment* must be the same as that generally laid down for large wounds of the belly, the state of the patient in regard to her puerperal condition being borne in mind (*c*). The dressings must be replaced when the secretion from the wound has penetrated through, or if there be any strangulation of the intestines or *omentum.* The removal of the sutures, if not previously required on account of inflammation, should not be before the eighth or tenth day, first indeed, the upper, and afterwards the lower ones. The *vagina* and mouth of the womb should be examined every day, and everything removed which can interfere with the lochial discharge. When scarring begins, a well-closing belly-band must be employed to prevent abdominal rupture, and all exertion avoided.

[**Michaelis** observes, in regard to opium:—"The employment of opium, at first in large, and afterwards in small doses, I consider the most important remedy for the purpose of guarding the nervous system before it become affected by so great an injury as the operation, for moderating the pain and for diminishing reaction." And as to the necessity of keeping the bowels freely open, he says, that "his own experience, and his observation of other cases, have disposed him to it; that there is scarcely a fully described successful case in which the relief of the bowels has not been frequent, indeed where there has not been severe *diarrhœa.* **Adametz** had the bowels moved on the last occasion, from the third to the twentieth day, almost daily six times, and on the fourth day nineteen times; that this was excessive I will not deny; the inconvenience, however, was trifling, and, indeed, had there not been on the fourth day so great a discharge she would have been with difficulty saved. It is, however, difficult to effect the relief at the proper time with the usual means. I believe, however, that we have in ice the safest and, in other respects, the most proper remedy; it at once operates quickly as a purgative if some doses of calomel be given with it." (pp. 25, 6.)]

1841. The following special proposals to diminish the danger of the

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(*a*) Gazette Médicale, vol. viii. p. 444. 1840.

(*b*) **Pfaff**; Mittheilungen, vol. ii. p. 119.

(*c*) Upon the after-treatment, see **Graefe**.

Cæsarean operation may be here mentioned:—*First.* The head of the child should be pressed up against the front of the womb and the belly by the hand passed through the *pelvis* up into the womb, and upon it and the white line, the cut made as far as necessary in order to hasten the expulsion of the child (*a*). *Second.* After the wound is made in the wall of the belly, immediately the womb, the *vagina*, and, if necessary, the mouth of the womb should be opened at a single cut, and the child drawn out of the womb (*b*). *Third.* According to Rietgen (*c*), a semilunar cut should be made from the crest of the hip-bone to near the pubic *symphysis*, through the skin, whilst an assistant, standing at the patient's left breast, thrusts down the womb from the right side, by which the skin over the region of the wound is stretched. A cut of similar extent through the muscles follows that through the skin, care being taken not to wound the *peritonæum.* The cellular tissue covering the *peritonæum* is to be loosened with the fingers, with the handle of the knife, or with the knife itself, and the cavity of the belly undermined. The straight director is now introduced into the *vagina*, and so directed that its point pushes the *vagina* above the middle of the right *linea innominata.* The operator now thrusts the stem of the director through the wall of the *vagina*, and enlarges the opening with a button-ended bistoury towards the bladder. The director is removed and the cut continued towards the *rectum* upon the right forefinger. If the cut can be so made that an edge of two or three inches of the *vagina* be formed on the right half of the neck of the womb, it must be divided obliquely with the scissors; the wound is then covered and the passage of the child watched. If necessary, the womb also may be cut into on the right side.

Rietgen (*d*) considers that the wound in the walls of the belly, made as above directed, gives but little width, on account of the oblique direction of the descending fibres of the external abdominal muscle, and that for the extraction of the child a second cut is necessary to divide those fibres transversely. Cutting into the mouth and neck of the womb seems in no case to be dispensed with, and after the first cut has been made through the cavity of the *vagina*, must be immediately proceeded with. By thus doing, the division of the hind part of the *vagina* is unnecessary, and the considerable bleeding which accompanies it is thereby prevented, and what there is may be easily and completely stanched with a sponge dipped in cold water. The best chosen part for the cut into the womb is under that fold of the *peritonæum* which passes upon the round ligament of the womb, and partly lies upon it. Astley Cooper's hernial knife answers best for opening the womb.

Baudelocque's (*e*) method agrees almost completely with that of Rietgen. He makes in the right-sided obliquity of the womb a cut upon the left side of the belly along the outer edge of the *m. rectus*, from the navel to an inch or two above the *symphysis.* The waters are discharged through the *vagina*, the legs and thighs bent, and, with the finger introduced at the lower part of the wound, the *peritonæum* is separated throughout the whole extent of the iliac pit, and above the iliac artery. One assistant then draws back the *peritonæum* and intestines, and another keeps the womb in its place by his hand applied to the belly. The operator introduces his hand into the wound, seeks for the iliac artery, and ascertains whether any branches pass from it around the *vagina*, and if there be, they must be tied before he cuts through them. The left hand smeared with oil is now carried into the *vagina*, which is to be lifted into the wound, and then cut into as low down as possible below its insertion into the neck of the womb, and the cut

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(*a*) Osiander; in Gött. gelehrt. Anzeig., 1813.

(*b*) Jörg, Versuche und Beiträge, p. 263. Leipz., 1806.

(c) Die Anzeigen der mechanischen Hülfen bei Entbindungen, p. 441. Giessen, 1820.

(*d*) Geschichte eines mit ungünstigem Erfolge verrichteten Bauchscheidenschnittes und Folgerungen daraus; in Heidelberger klinischen Annalen, vol. i. p. 263.

(*e*) Thèse Inaugurale. Paris, 1823; and Nouveau Moyen pour délivrer les femmes contrefaites à terme et en travail, substitué à l'Opération Césarienne, suivi de reflexions sur ce sujet, par F. T. Duchâteau. Paris, 1824. 8vo.

lengthened to four inches and a half. In left-sided obliquity of the womb, the cut is to be made on the right side. BAUDELOCQUE calls this operation *Gastroelytrotomy.*

PHYSICK (*a*) proposes making the cut horizontal above the pubic bones, and to dig here beneath the *peritonæum.*

Experience has not yet decided on the value of these several methods, especially upon the various difficulties in bringing the child into the world. The advantage of not opening the cavity of the belly is counterbalanced by the tearing away and separating the *peritonæum,* from which dangerous inflammation, effusion, and collection of pus would necessarily ensue.

[From the account which MICHAELIS has given of the woman ADAMETZ, it is evident that, with good reason, he considers a repetition of the operation as more likely to be successful than the first, on account of the adhesions which the womb acquires to the wall of the belly. He observes, that "the growing together of the walls of the belly with the womb had the most favourable influence upon the subsequent operations. This union had already taken place, at the second operation, at one part; in the third, three places had united; in the fourth, the union was complete as far as the cut extended. But I consider that even a partial union has an important influence, by preventing the wound of the womb separating so far from the wall of the belly, that the secretion from the former cannot find a free passage into the latter. It has also the advantage in this operation that if it (the adhesion) be above, the intestines cannot protrude there, but if it be complete, there can be no protrusion. This would be a very untoward condition, if MERREM's opinion (*b*) were correct, that 'in the adhesion the wall of the belly, in the latter half of pregnancy, there would be tearing from the little extensible belly-wall, and thus the flying open of the whole imperfect scar of the womb would necessarily occur;' and that 'in such cases it was not to be supposed that the *fœtus* would be carried its full time.' MERREM, on the one hand, draws his conclusions from one single case; but nature, on the other, has other means than theory imagines. These are, that the adherent wall of the belly, or the scar, possesses the same extensibility as the womb itself. The first wound of five inches had, in the second pregnancy, lengthened itself to ten inches, and was four inches broad. In the third pregnancy it was twelve long, and five inches broad; and in the fourth pregnancy still larger. The contraction of the scar after the fourth pregnancy was most surprising, for although the cut itself after some days had diminished to half its length, although it at last diminished from five inches to one, yet was the wall of the belly, at the part where the womb adhered, smooth and free from fold; but where it did not adhere, were two slight transverse folds." (pp. 22, 3.)]

V.—OF GASTROTOMY.

(*Gastrotomia, Laparotomia,* Lat.; *Bauchschnitt,* Germ.)

1842. If a *fœtus* be developed in the Fallopian tube, in the ovary, or in the cavity of the belly, or if by bursting of the womb or *vagina* it escape into the cavity of the belly, and its extraction cannot be effected by the natural passages, dangerous symptoms in regard to the mother are to be feared whether the child be alive or dead, and there be no signs that it can be discharged by the process of ulceration in one way or other by the natural powers, then *opening the cavity of the belly* is required. The other diseases which render this operation necessary have been already mentioned.

The symptoms of an extra-uterine pregnancy are never so manifest, that before the usual period of delivery the operation can be decided on; although, if it can be performed between the second and fifth month, the hope of a successful result is by far greater than when it is undertaken at the ordinary termination of pregnancy; for in these cases the abdominal bowels are always considerably altered, the whole constitution of the patient is greatly disturbed; it is not certain that the *placenta* can be completely separated; and in the separation of the membranes, dangerous bleeding is always to be dreaded. In what way also is the lochial discharge to be got rid of? It must also be remembered that the *fœtus,* in extra-uterine pregnancy, very rarely

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(*a*) DEWEES, Compendious System of Midwifery. Philadelphia, 1824.

(*b*) Gemeinde Zeitschr. für Geburtsk., vol. iii. p. 338.

reaches the full period, that on the contrary it not unfrequently remains enclosed and crumpled up in the membranes, which are thickened and hardened; or that in consequence of the irritation of the *fœtus*, inflammation, adhesion of the neighbouring parts, and throwing off the *fœtus* piecemeal, by suppuration, through the openings of the abscess or by the *rectum*, may happen; so that, in most cases, it may be best to assist nature in the discharge of the *fœtus*, in the way just mentioned, by means which encourage suppuration, and the like. According to Heim (*a*), most violent pains, and the most pitiable and deplorable condition may exist, and in one case did for ten years.

[It is an important question, whether a womb can be ruptured completely, excepting its peritoneal coat, within which the *fœtus* may be still retained, and so found by the operation of gastrotomy. Blundell (*b*) thinks it can, and gives as an example Barlow's (*c*) case, in which it is stated "the *uterus* was very thin, scarcely exceeding that of the *peritonæum*, and equally so throughout the whole extent of the incision." (p. 159.) Hull (*d*), however, considered "that the child had escaped through a laceration of the *uterus* into the *abdomen*, enveloped in the secundines, and that Barlow had merely divided the membranes, when he fancied he had divided the *uterus*." (p. 73.) But Blundell says:—"To me it appears to have been a case of rupture of the muscular substance of the *uterus*, without rupture of the uterine *peritonæum*." (p. 552.) Under such circumstances the operation performed would be merely gastrotomy, and not the Cæsarean.]

1843. When in a tubular or ovarian pregnancy the membranes enclosing the *fœtus* are torn, or by a rent of the womb, the *fœtus* escapes into the cavity of the belly, in which latter case the patient, after severe suffering and labour-pains, feels suddenly easy, and has a sensation of warmth spreading over the belly, the pulse small and quick, and the like, death in general soon follows.

1844. No definite rules can be laid down for the place and direction of the cut. At the part where the *fœtus* is most distinctly felt, and towards which an assistant should press it with his hands spread flat on both sides, a cut of about six inches long should be made through the skin and muscles down to the *peritonæum*, which must be then divided, as in the Cæsarean operation. If the *fœtus* be uncovered by the membranes, it may be removed in any convenient way; if it be enclosed, the membranes must be cautiously separated, the *fœtus*, and afterwards the membranes, if not prevented by adhesion (*e*), and the *placenta* removed. If the *fœtus* be partly in a rent of the womb, it must be taken out cleverly, if possible without enlarging the rent. If separation of the *placenta* be impossible, the navel-string, after having been tied, must be left hanging out of the wound till the *placenta* come away. The dressing and after-treatment are the same as in the Cæsarean operation.

1845. If an abscess or fistulous opening have already formed, it must be cut into or enlarged for the purpose of removing the *fœtus* whole or piecemeal (*f*).

VI.—OF CUTTING THROUGH THE PUBIC SYMPHYSIS.

(*Synchondrotomia*, Lat.; *Schoosfugenschnitt*, Germ.; *Symphyséotomie*, Fr.)

Camper, Epistola de emolumentis Sectionis synchondroseos Ossium Pubis. Groening, 1774.

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(*a*) Erfahrungen über Schwangerschaften ausserhalb der Gebärmutter; in vermischten Med.-Schriften, p. 36. Berlin, 1836.

(*b*) Lectures on the Theory and Practice of Midwifery; in Lancet, 1837-38, vol. ii.

(*c*) Medical Records and Researches. London, 1798. 8vo.

(*d*) Defence above cited.

(*e*) Veiel; in Würtemb. Med. Correspondenzbl. 1840.

(*f*) Fiedler, Dissert. de Laparotomia, novissimoque ejus exemplo. Viteb., 1811. 4to.

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von Krapf, K., Anatomische Versuche und Anmerkungen über die angebliche Erweiterung der Beckenhöhle, u. s. w. Part I. Wien., 1780. Part II., 1781.

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Walter, von der Spaltung der Schaambeine in schweren Geburten. Berl., 1782.

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Baudelocque, An in Partu impossibili Symphysis secanda? Paris, 1776.

Salomon, Verhandeling over de Nettigheit der Schaambenschneede, etc. Amsterdam, 1813.

1846. Cutting through the pubic *symphysis* is required in a narrowing of the antero-posterior diameter of the outlet of the *pelvis* of from two and a half to three inches, and in a narrowing of the transverse diameter of the brim and outlet of from two to three inches.

To lay down determinate indications for cutting through the pubic *symphysis* is difficult, as the experiments which have been made upon the enlargement of the pelvic dimensions, after division of the *symphysis* in dead bodies, have presented different results, and it has happened with this operation, as with many others, that it has been, on the one hand, too much vaunted, as on the other it has been unhesitatingly discarded. The indications here given rest on the experiments and practice of Ansiaux (*a*), from which it appears that the pubic bones, after the division of their *symphysis*, are capable of a separation of three inches, without the sacro-iliac *symphysis* being torn; that by this separation the outlet acquires an additional extent of ten lines, and that by the entrance of a part of the child's head into the space between the separated pubic bones, a still further space of five lines is obtained. This proportion may, however, vary in some subjects, which, however, can previously be just as little decided, as can any ossification of the sacro-iliac *synchondrosis*. In deciding, however, upon the results of cutting through the pubic *symphysis* in the dead subject, it appears to me an important circumstance, whether the experiments have been made sooner or later after death.

According to Vrolick's (*b*) experiments, in consequence of the intrusion of the rump-bone in the parting asunder of the separated pubic bones, the increase of the pelvic space is little, and therefore a large restriction of the cut through the pubic *symphysis* is necessary.

Further experience is still requisite to determine how far this operation is applicable in the artificially produced premature labour (*c*).

1847. The operation is to be performed in the following way:—The patient having been placed on her back on a narrow couch covered with a mattress, the *pudenda* cleared of hair, and the *rectum* and bladder, in the latter of which the catheter is to remain, emptied, a cut is to be made at the part immediately corresponding to the pubic *symphysis*, beginning half an inch above the upper edge of the share-bone, and carried down to the *clitoris*, without wounding it. In the direction of this wound every thing is to be cut through, down to the cartilage. An assistant now presses the bladder aside with the catheter, and the operator introduces a button-

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(*a*) Clinique Chirurgicale, p. 79.

(*b*) Versuche über das Zurückweichen des heiligen Beines sowohl im unverletzten Becken, als nach der Schaambeintrennung; in von Siebold's Journal für Geburtshülfe, vol. i. p. 542.— von Wy, Ueber die Ausführbarkeit und den Nutzen des Schaamfugenschnittes; in same vol. i. p. 502.—Orne; Experiments to determine the applicability of the Sectio Ossis pubis; in Med. Commun. of the Massachusetts Med. Soc., vol. i. Boston, 1808.—Coujon, C., Essai sur la Synchondrotomie pubienne. Paris, 1825. 4to.

(*c*) Reisinger, Die künstliche Frühgeburt, als ein wichtiges Mittel in der Entbindungskunst. Augsburg, 1820.

ended curved strong bistoury at the lower edge of the pubic *symphysis*, and thrusting it along the hind surface, divides the *symphysis* from within outwards. Any bleeding must be stanched by pressure or ligature.

If the *symphysis* be ossified, a little straight button-ended thin saw is to be applied on its upper edge, and division made with some short strokes, during which the assistant draws the soft parts as much aside as possible.

1848. The share-bones now in general separate from each other, which the assistants holding the thighs, allow to take place but very slowly, and the labour proceeds by the natural powers, or is completed by artificial aid. If the bones do not part from each other, the thighs must be slowly separated, till the space between the divided bones has acquired two, two and a half, to three inches extent.

1849. After delivery, the bones are to be brought together, as closely as possible, in doing which special caution must be had that no soft parts be between them. The wound is united with sticking plaster, covered with lint and a compress, and the *pelvis* supported by a close-fitting girdle applied around it.

1850. The *after-treatment* is specially directed by the ensuing symptoms of inflammation. If the bladder or *urethra* be wounded in this operation, a catheter must be introduced. If suppuration, fistulous sores, *caries*, or *necrosis* occur, their treatment must be according to the usual rules. Inflammation of the sacro-iliac *synchondrosis*, consequent on the extension and tearing it has suffered, requires antiphlogistic treatment. If collections of pus form, they should be opened early. An imperfect union of the share-bones, by which lameness or halting is produced, renders the continued application of a firmly-enclosing girdle, perfect rest and the use of strengthening baths necessary.

B.—COLLECTION OF NATURAL FLUIDS EXTERNAL TO THEIR PROPER CAVITIES AND RECEPTACLES.

I.—OF THE BLOOD SWELLINGS ON THE HEADS OF NEWLY-BORN CHILDREN.

LEVRET, in Journal de Médecine, vol. xxxvii. p. 410. 1772.

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FEIST, F. L., Ueber die Kopfgeschwulst der Neugebornen. Mainz, 1839.

CHELIUS; in Heidelb. Med. Annalen, vol. vi.

1851. Upon the heads of newly-born children there are not unfrequently observed soft, fluctuating, generally painless, circumscribed swellings, upon which neither the hair nor the skin is at first affected, and in the interior of which, between the *pericranium* and the skull blood is collected. It is usually seated on the parietal bones, more frequently than on the right side; it has, however, been observed sometimes on the back of the head, and on the forehead. It varies in size from that of a hazel nut to that of a hen's egg, and even more. Sometimes, though rarely, however, it spreads over the whole parietal bone, sometimes, though rarely, it spreads over both parietal bones at once; several of these tumours of different size may also exist on different parts of the skull. Immediately after delivery, they are in general little raised and stretched, but they grow more quickly or slowly in the first few days, when the swelling is less distended and pappy, and fluctuates. The skin covering it, which was at first natural, afterwards assumes a shining, grayish, reddish-blue or violet colour, according to its tension and expansion. Some practitioners (LEVRET, NAEGELE, HOERE) have observed, by the application of the hand, whilst the swelling is on the increase, a pulsation, or a peculiar hardness (HEY, FELDER) in them, which, however, neither others nor myself could perceive. When the base of the swelling is pressed with the finger, a firm, somewhat raised edge is felt, so that it *seems* as if a part of the bone were lost.

NAEGELE's opinion (*b*) that the blood swelling occurs only on the parietal bone is in opposition to the earlier statements (*a*) and to the observations of others, (MOMBERT, SCHNEEMAN, DIEFFENBACH, BURCHARD,) who have noticed these blood swellings on the occipital and frontal bones.

1852. In its further course, the tumour, if left alone and not immoderately handled, either diminishes gradually of itself, the blood becoming absorbed, and the *pericranium* re-applying itself, or, what is more usually the case, if the swelling be of large size, it undergoes a peculiar sort of metamorphosis, which consists in a thickening of the *pericranium*, and its conversion into bone. The tumour has a peculiar elasticity and parchment-like condition, so that when pressed, it is like a thin plate of metal, which after being pressed down, rises again, and has a peculiar crackling. The swelling gradually becomes harder, and at last as hard as bone, so that like an *exostosis*, it becomes firmly attached to the other bones; and then by degrees, in a space of time, between four and twelve months, it shrinks, and at last entirely disappears, so that not the slightest trace of it can be discovered.

This important metamorphosis, which the blood swelling undergoes, I first (*c*) described, and pointed out its influence upon the treatment. Although FEIST has ascribed this observation to SCHMITT (*d*), and has been followed by NAEGELE, who has confirmed it, and though NAEGELE (*e*) has made no reference to my name on this subject, those, however, who compare my essay of 1828, with those before and since that time, will at least not misplace the plagiarism.

(*a*) FEIST, above cited, p. 5–7.

(*b*) Erfahrungen und Abhandlungen, p. 247, *note*.—ZELLER, above cited, p. 1.

(*c*) Heidelb. klinisch. Annalen, vol. iv. 1828.

(*d*) Salzburgh Med.-Chir. Zeitung., vol. i. p. 328. 1819.

(*e*) VELPEAU, Traité complet de l'Art des Accouchemens, vol. ii. p. 596. Paris, 1834. 2nd Edit.

I first mentioned (*a*) that Schmitt had pointed out this metamorphosis; and nothing more could be said of Schmitt's observation. For according to Goelis, during the treatment of a blood-swelling with caustic, when the tumour becomes as hard as bone, and immovable, and is not dispersed by the maintenance of suppuration and the use of resolvent applications, it must be left alone, and gradually subsides. But Schmitt has asserted the directly contrary and decidedly inapplicable explanation of this process, "that the portion of bone lying beneath the swelling, which is at first pressed by the weight of the blood is, after the absorption of the blood, again raised up by an oscillation depending on its own elasticity, to which the increased thinning of the bone, perhaps induced by its maceration in the blood, or the more influential act of absorption, seems to give some probability." It may be further remarked, that this observation of Schmitt has been noticed by no subsequent writer, and is not even hinted at in Zeller's Dissertation.

1853. Any other termination of this disease, when left to itself, cannot well happen. It is indeed stated, that if the blood can find no escape, it putrifies, is converted into a bluish, brownish, or soot-coloured substance, which is either thinly or thickly fluid, and has either a stale or putrid smell; and as the thickening of the *pericranium* is prevented by the external discharge of the ichor, the surface of the bone is attacked, its whole thickness destroyed, actual perforation of the skull takes place, and death follows. The blood-swelling may also sometimes run on to suppuration (*b*). From my own observation, however, as well as that of others, I hold it decided that this result, although it may actually take place, is not to be ascribed directly to the blood-swelling itself, since, as Dieffenbach has correctly remarked, the excess of blood, and the great nutritive condition of children, strongly withstands this mischievous effect of the pressure of the outpoured blood. Some other influences must, therefore, be added, as improper treatment with destructive remedies, either after opening the swelling, or disease in the child, by which absorption is set up, and the destruction of the bone produced.

The cases in which actual perforation of the skull has been observed, confirm the above stated opinion, inasmuch as in all there was an opening of the tumour. Thus in the case related by Naegele (*c*), in which, after opening the swelling, the treatment was unavailing; Kraus's (*d*) case, Burchard's cases (*e*), show also this perforation; but a precise statement of all the previous conditions is wanting, and in one case it is even stated that there was previous catching cold of the child, and disease of the mother, and the treatment was the midwife's.

1854. The *causes* and modes of origin of blood-swellings are as numerous as the various opinions which have been put forward in reference to them, so that many have considered their generic relations as completely in the dark. Experience shows that they occur especially after easy and, more particularly, after quick labours; they have even been met with after breech deliveries, and also after difficult delivery and delivery with the forceps. That the blood-swelling is always accompanied with a diseased condition of the bone, and destruction of its outer table, so that the blood oozes out of the rotten bone as out of a sponge, is contradicted by experience. The roughness of the bone, as well as the destruction of the outer table, which is observed, not in all cases, after opening the swelling, but particucularly when the opening is made late, is the consequence, not the cause, and depends on absorption. The opinion that the blood, by *extensive* bursting, is poured out under the *pericranium*, is not proved by observation; and in opposition to this, as well as to the notion of an original disease of the bone, it

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(*a*) Handbuch, 1829. Third Edition.

(*b*) Busch; Handbuch der Entbindungskunst, p. 442.

(*c*) Erfahr. und Abhandl., p. 252.

(*d*) Gemeinsame deutsche Zeitschr. für Geburtskunde, vol. vi. p. 286.

(*e*) Above cited.

especially applies that when such are the actual causes the cure of the disease cannot so easily follow. The assumption of a mere mechanical influence has therefore been attempted to be denied, in that this swelling arises more frequently and immediately after difficult delivery, but of which experience proves the direct contrary. Notwithstanding this objection, the origin of these swellings from mechanical influence is, however, the most probable, and is specially confirmed by their, in general, easy and quick cure. We do not, therefore, trouble ourselves about a considerable degree of pressure, but specially about an unequal pressure, and enduring but for a short time, against a projecting or angular part, by which the vessels between the skull and *pericranium* are either torn or so injured, that they afterwards pour out the blood by transudation, in consequence of which, the origin of the swelling is first apparent a few days after birth.

The various opinions brought forward upon the nature of the blood-swellings of the head, may be referred to the three following causes:—*first*, primitive disease of the bone; *second*, diseased condition of the vessels; and *third*, mechanical violence. **Michaelis** holds the first, that in all these swellings, the external table of the bone is wanting, and the *diploë* bared; that the affection of the bone is primary, and the pouring out of the blood secondary. **Palletta** also speaks in a similar way. This opinion, however, is contradicted by many cases, in which, on opening these swellings, the bone has been found smooth, and the change which it, at a later period, somewhat suffers, is considered as the consequence of absorption, depending on the pressure of the blood. This entirely groundless opinion has, however, been recently again put forward by **Langenbeck** (*a*), so that the disease appears, in so far a *vitium primæ formationis* as the *tabula externa ossium calvariæ* at one part (!) is deficient, so that the *venæ diploëticæ* are covered only by the *pericranium, galea aponeurotica*, and skin. As the *venæ diploëticæ* have very thin walls, so the blood either escapes from them by *rhexis* or by transudation, and distends the *pericranium* into a fluctuating swelling to that point, where the external table is not deficient. The raised edge of bone surrounding the swelling thus points out the place where the two bones lie upon each other, at the boundary of the hollow. If the external table be not wanting, it must, according to **Langenbeck**, be very porous, and many vessels penetrate it which serve as *emissaria Santorini*, and are the sources of the blood found in it and beneath the *pericranium*.

A diseased condition of the blood vessels has been, in different ways, assumed as the cause of these swellings. According to **Naegele**, perhaps the varicosity of the blood vessels penetrating the skull, which commence with the growth of the bones of the skull, and are torn previously to, or during birth, may cause the outpouring of the blood, the increase of which after birth may depend on respiration and the new circulation. **Stein** assumes an unnatural structure of the vessels; **von Siebold**, a similar condition to *nævus maternus* (teleangiectasy?); **Brandau** and **Hueter**, an original weakness of the vessels, as he has found these swellings only in weakly children; **Schneeman**, a loose connexion of the *periosteum* with the bone in but little well-grown children, and the rush of blood in the ensuing respiration; and **Lang** attributed the cause to the encircling of the neck with the navel-string in weakly children. **von Ammon** (*b*) imagines, that according to the pathological observation of **Hœre**, **Osiander**, **Burchard**, and others, the vascular system of the bones, the *dura mater*, as well as the *pericranium*, are changed by disease. He himself has sometimes found the veins enlarged upon, and in the bones of the head. The disease, indeed, scarcely depends upon a deficient developement, but is to be considered as consequent on a pathological formative process.

Osiander (*c*) asserts, that a small artery, mostly a *vasculum emissarium* tears, either by the blood collecting or from pressure, if the head be squeezed against the one side of the *pelvis*, or by the forceps if unequally applied, and that the swelling therefore takes place, especially on the parietal bones, where the *emissaria Santorini* are found. **Wendt**, **Klein**, **Capuron**, and **Carus** attribute it to the pressure on the head during its passage through the *pelvis*; **Becker** (*d*), on the skull-bones being thrust in;

(*a*) von Ammon's Monatsschrift für Medicin, Augenheilkunde und Chirurgie, vol. i. p. 76.

(*b*) Die Chirurgische Pathologie in Abbildungen, vol. i. p. 20.

(*c*) Handbuch der Entbindungskunde, vol. ii. p. 208.

(*d*) Hufeland's Journal, vol. lvii. pt. iii. p. 80. 1823.

Neumann (*a*), on the great overlapping of the parietal bones during delivery; Wokurba (*b*), on a distension of the soft parts of the head, accompanied with greater or less pressure, and depending rather on one, than on the coincidence of several causes, in which the vessels, in consequence of the peculiar condition of the infant organism, permit a trickling through of the blood. Bartsch assumes a mechanical violence, which presses on a projecting part of the bone, (as, for instance, the crest of the hip-bone,) for a short time, and unequally, or a violent though short enduring irritation with which the vessels are affected, and which, together with the influx of the blood from the commencing respiration, they cannot withstand, and transude the blood through the weakened walls of the vessels. Paul Dubois (*c*) seeks for the cause in the peculiar structure of the bones of the head. In their still imperfect ossification, they present fibres lying near each other, which from the elevation of the parietal bone, diverge, as from a common focus, towards the periphery. Between these bony fibres there remain small fine clefts, which have not either the length or whole thickness of the bone. They exhibit a correspondently spongy structure, appear to be penetrated with a large quantity of blood, so that after the removal of the *pericranium* and *dura mater*, the blood may be squeezed out of these pores and interspaces. The blood appears therefore during life to be enclosed in the interspaces of the bony fibres by the *dura mater* and *pericranium*, and to stand in close relation with them. If now one or other of these membranes be deficient at one small part, an outpouring of blood takes place, and this may happen from any violence operating on the head of the *fœtus* in its passage through a narrow *pelvis*, in its passage over hard, unyielding walls, or by the application of the forceps. In the same way, on account of an original disposition, the natural connexion of the *pericranium* at a certain point may be so weak, that the impulse even of the circulation may raise it up. In a similar manner, even a disease of the bone, as it increases the influx of blood, can produce outpouring of blood by its destroying the natural connexion of the *pericranium*. Busch (*d*) observed on the hind-head of a child, probably many days dead, and delivered by the violent use of the forceps, a bluish, blood-sac, on opening which, there appeared a communication with the *sinus*. The opinion founded on this circumstance as to the origin of blood-swellings of the head is less to be received, as the case was not that blood-swelling of the head which we are now considering. Flint (*e*) describes a similar case of an outpouring of blood in the hind-head of a child several days after birth, which, as dissection proved, was connected by an opening in the diseased bone with the *sinus* of the brain; on which account, the child died after a cut had been made into it.

1855. The result of the examination of the cavities of these blood-swellings after their previous opening during life, or on examination after death, varies according to the different period of the course of the disease. In the beginning, the blood is found more pale-red, and fluid; afterwards, a thicker, clotted, and blackish blood, even a tough jelly, (Palletta,) sticking to the bone, is collected between the skull and the *pericranium*. The external surface of the bone is sometimes rather wasted but smooth, sometimes rough and eaten away, and, under the already mentioned circumstances, the destruction of the bone is more considerable, and penetrating even to the *dura mater*. At the commencement of the swelling, the *pericranium* is firmly attached to the bone, but afterwards, when ossification begins from the *pericranium*, a delicate bony layer is observed on its internal surface, and, as it were, attached to it (Krauss); and if this ossificating process extend further, a cartilaginous layer with some points of bone, or a firm bony plate appears, which imperceptibly passes into the outer surface of the bone at the base of the swelling, and from which the *pericranium* can be separated as easily as from every other part of the bone. The cavity beneath this bony plate is filled with a grumous, bloody, gelatinous mass. (Burchard.) The upper surface of the skull

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(*a*) Rust's Magazin, vol. xxi. p. 371.

(*b*) Oestreich. Med. Jahrbücher, vol. iv. p. 421.

(*c*) Above cited.

(*d*) Ein Beitrag zur Aufklärung des Wesens der Schädel-Blutgeschwülste neugeborener Kinder; in Heidelberger klinischen Annalen, vol. ii. p. 245.

(*e*) New England Journal of Medicine, vol. ix. p. 112.

bones is rough, porous, and intimately connected with the gelatinous mass; in some cases even perforated. (BURCHARD.) If when the *dura mater* have gradually wasted, that part of the bone be examined, in children who have afterwards died, where it has been eaten away, upon removing the skin not the slightest alteration is found, the *pericranium* is in its natural condition, and may be just as well separated as at other parts; on the bone itself there is observed only to the extent which the earlier blood-swelling had occupied, a greater thickening which especially affects the outer table, and on sawing through the bone a greater development of *diploë;* otherwise there is no change of texture in the bone. These slight variations even are probably entirely lost (*a*).

BURCHARD, from the existence of this bony layer beneath the *pericranium*, has led himself into a mistake, by supposing it *the raised and expanded outer table* of the bone; and hence has arisen the opinion of a blood-swelling, in which the blood is collected *between the two plates of bone.* The falsity of this opinion is proved by what I have above stated as to the course of the ossifying process in blood-swellings. It is further completely irreconcilable with the anatomical character of the skull-bones of a newly-born child, in which nothing can be said of a *diploë*, in its peculiar sense, perhaps even only at certain parts of an external and internal plate.

1856. The *distinguishing characters* of blood-swellings from other tumours on the heads of newly-born children, for instance, the common head swelling, (*caput succedaneum*,) the congenital *hernia cerebri*, the so-called water-bags, and the blood-sacs, which are connected with one of the sinuses (BUSH, FLINT) are, their circumscribed, elastic, fluctuating nature; their usual seat on the parietal bones, and the impossibility of diminishing them by pressure, in which no symptoms of pressure on the brain arise. It must, however, be observed in reference to congenital *hernia cerebri*, that when, as usual, it happens in the sutures and fontanels, its existence is proved by anatomical examination at other than at the seat of the sutures (*b*). The pulsation which is also given as a characteristic sign in *hernia cerebri*, is not always distinctly perceptible, and even in blood-swellings may be observed; the pulsation, however, in *hernia cerebri* is always more decidedly manifest than in blood-swellings. In *hernia cerebri* an actual opening in the bone can be felt; in the head blood-swelling, when the tumour is not very tense, the bone may be felt by pressing strongly upon it, inasmuch as in these swellings the hard edge at its base is not formed by loss of substance of the bone, but by the swelling of the soft parts, as in common boils. In the blood-sacs connected with a *sinus*, the diagnosis is founded on the perceptible edge of the pieces of bone, and the possibility of diminishing the swelling by pressure. A blood-swelling cannot be confused with *œdema capitis;* from the so-called partial external *hydrocephalus*, in which the water is collected under the *galea aponeurotica* or the *pericranium* itself, is a distinction scarcely possible; the existence of such kind of watery head is rightly doubted. External violence which produces bumps, always more or less injures the skin, which is tinged with blood and discoloured. The *diagnosis* of the blood-swelling may be very difficult when the ossifying process has already proceeded far, and the tumour has not been previously seen. OSIANDER (*c*) manifestly fell into this mistake, against which only the observation of its peculiar elasticity, and careful inquiry of its earlier condition can guard us.

(*a*) My observations in Heidelb. klinisch. Annalen, vol. vi. p. 541. 1830.

(*b*) HÖFLING, Zwei Fälle von Hirnbruch; in CASPER'S Wochenschrift. 1835. No. 23.

(*c*) Handbuch der Entbindungskunst, vol. ii. *par.* 205. Tubing., 1821.

Osiander believes the common blood-swellings cannot be confused with the congenital *diseased bone swellings*, which certainly belong to those very great rarities, in which the bone is swollen in the *diploë* (?), in which swelling however the upper table is never wanting, but only *spongy* and *raised*. With such swellings of the bone nothing can be done; and cutting into them would certainly always be followed by death. That Osiander here has mistaken blood-swellings which had already gone on to ossification, and has given of them, as has Burchard, a false description, there can be no doubt. In a case, where two swellings on the right parietal bone, the one more than the other presented the above-mentioned conditions, and in which several practitioners asserted a suspicious degeneration of the bone, I made known the true nature of the disease and advised its being opened; and its fortunate result verified my opinion, coagulated blood escaping after the opening. In another case which I showed Naegele, he admitted that he should not have known it for a blood-swelling (*a*).

1857. The *prognosis*, if the disease be properly treated, is generally not unfavourable, if it be unconnected with *syphilis* or atrophy. All blood-swellings on the heads of newly-born children either disperse in the space of fourteen or twenty-one days by absorption of the blood poured out beneath the *pericranium*, or they subside after a longer time, after the swelling has become as hard as bone, very gradually. From the fear of the bone becoming affected from the continuance of the blood under the *pericranium*, from the opening of the tumour being omitted or delayed, which is not supported by experience, and from not knowing what happens to these swellings if left alone, persons have been led to the proposal of the most different reasons for their treatment. At least I have seen, up to the present time, in many cases where the *pericranium* has been ossified, very large swellings subside without a single accident, in the course of a year.

1858. The *treatment* of blood-swellings aims either at their dispersion by increasing the activity of the absorbents and thus removing the blood, or emptying the blood by opening the swelling.

1859. The *dispersion of these tumours* is usually attempted by vinous, aromatic applications, by applying a solution of hydrochlorate of ammonia, lead wash diluted, arquebusade, decoction of oak bark, and the like. It appears, however, that with the application of these remedies, the necessarily accompanying slight compression perhaps contributes more to the dispersion than the mere operation of the remedies. I know instances in which the dispersion of these swellings followed simply from compression with a pad and a close-fitting hood; and it must also not be forgotten that many of these swellings, especially if they be small, entirely subside without any treatment. Henschel and Schneemann have recommended as the most efficient remedy, compression by means of a hood, lined opposite the seat of the swelling with several folds of tinfoil. In no case should very irritating or cold applications, or much compression be employed; by which in manifold respects injurious influence might be excited. I doubt whether there be a single case of blood-swelling of the head of newly-born children, where the tumour was left to itself, which ever had any bad result; or in which the opening would have been considered necessary: and as I formerly asserted on this point, that if in a space of from ten to fourteen days, the swelling under the above-named treatment had not diminished, but remained equally large, and was of unusually large size, it was most advisable to open it, so can I now from repeated experience assert that this practice is to be considered safe and free from danger. It must, however, apply only to those cases which occur very

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(*a*) My observations; in Heidelberg. klinisch. Annalen, vol. iv.

rarely; so that the opening is only the exception, and not as most writers on this disease have laid down, to be taken as the rule. If the process of ossification have already begun, nothing must be done except leaving the swelling entirely to itself, because after opening, the upper wall cannot, on account of its firm nature, apply itself, and a tedious suppuration ensues, as I have in one case witnessed.

An early opening is equally objectionable, because in consequence of it there is often a considerable escape of pale-red blood, whilst in a later made cut black blood is discharged in no great quantity.

The application of lunar caustic upon the swelling, and the keeping up suppuration after the separation of the slough for the purpose of favouring the dispersion of the tumour, as recommended by Goelis (*a*), is on many grounds objectionable (*b*).

1860. Opening the swelling is best done with a lancet to such extent as to allow the blood to flow out freely. Some threads of fine lint must be placed between the edges of the wound, and fixed with sticking plaster; and over all a compress and close-fitting hood. For the first few days ordinarily a somewhat bloody, afterwards a yellowish serous, and at last a somewhat purulent fluid is discharged; but on renewing the dressings after a few days the integuments have generally become in some degree united to the skull, and the cure soon follows. If, after the opening of the swelling, the surface of the bone appear rough, the dressing in this simple way must be employed.

Opening the swelling by a crucial cut or throughout its whole length, is unnecessary and improper; the introduction of a seton (Palletta) is objectionable. The simple puncture of the swelling with the lancet, and closing the opening, may, if at the same time dispersing remedies and a compress be used, effect a cure. Should the fluid collect again, the united edges of the wound may be easily separated with a probe, and the fluid having been discharged, the cure follows. When Dieffenbach observed, after small incisions, a secretion of ichor for several weeks, without the skin adhering in the least, and after a free opening that a speedy cure ensued, and when von Ammon supposes that the blood-swellings more frequently heal artificially than by the natural powers, the cut for assisting the discharge of the blood, the production of an adhesive inflammation, or of a fresh natural activity, must be carried deep down to the *pericranium*, even into the *diploë*, and not merely through the whole extent of the swelling, but into the sound parts of the neighbouring coverings of the head, inasmuch as small cuts, which are rather punctures than cuts, produce venous bleeding from the varicose vessels, difficult to be stanched, and which can only be stopped by a proper long and deep cut. My own experience and that of others so completely contradicts this, that these bad consequences must certainly be ascribed more to some other circumstances in the treatment, the time of the operation, and the like, rather than to the kind of opening. Further, as regards von Ammon's opinion, it may be observed that what I have already sought to employ against Burchard, applies to it also.

Hoere (*c*) describes a case of a simultaneous collection of blood between the *pericranium* and the skull, and the *dura mater* and the skull, with which there was at the same spot a penetrating cleft of the bone. The internal swelling was as large as a pigeon's egg, and had formed a pit in the brain of corresponding depth. The outer table of the skull was unchanged, but the inner was eaten away, and at one place entirely wanting; at one spot also production of bone seemed to have again begun. If Hoere suppose that the internal swelling had arisen first, and that by the changes of the bone the fissure had been dependent on the birth, when the blood collected beneath the *pericranium* had sunk down during birth, for which the destruction of the inner table spoke; yet is this a merely voluntary assumption, and incorrectly has been founded upon it a division of blood-swellings of the skull into *internal* and *external*, a division which Burchard assumed, and added the collection of blood between the plates of the skull as a third form of these swellings, against the admission of which I have already given reasons.

(*a*) Salzb. Med.-Chir. Zeitung, 1822. No. 81, p. 47.—Praktische Abhandlungen über die vorzüglichsten Krankheiten des kindlichen Alters, vol. ii. Wien, 1818.—Schmitt; in Salzb. Med.-Chir. Zeit., 1819. No. 21, p. 327.

(*b*) Zeller, above cited.

(*c*) Above cited.

II.—OF HÆMATOCELE.

(*Hæmatocele*, Lat.; *Blutbruch*, Germ.; *Hématocèle*, Fr.)

Pott Percival, The Chirurgical Works of, vol. ii. p. 382. London, 1783.

Follett, Journal de Médecine continué, vol. xiii. p. 422.

Cooper, Sir Astley, Observations on the Structure and Diseases of the Testicle. p. 209. London, 1830. 4to.

Brodie, B. C., A Clinical Lecture on Hydrocele and Hæmatocele in London Medical Gazette, vol. ix. p. 926. 1832.

Curling, Thomas B., A Practical Treatise on the Diseases of the Testicle and of the Spermatic Cord and Scrotum. p. 236. London, 1843. 8vo.

1861. *Hæmatocele* is a large outpouring of blood into the various coverings of the testicle. The extravasation may be seated in the cellular tissue of the *scrotum*, in the vaginal tunic, or in the testicle itself.

[This division of hæmatocele is similar to that made by Pott; but among most modern British Surgeons the term is restricted to a collection of blood within the vaginal tunic alone. Herbert Mayo (*a*), however, observes:—"This term is given to two affections, one effusion of blood, the other of sanguinolent *serum* into the *tunica vaginalis*. The latter, I believe, may alternate with hydrocele, the secretion being from an accidental cause dark and turbid at one time, clear and serous at another. It may likewise arise from blood being mixed with the *serum* of the hydrocele, in consequence of a bruise on the *testes*, or from a vessel having been punctured in tapping a pre-existing hydrocele."]

1862. The yielding nature of the cellular tissue in the *scrotum*, the size of its cells, and the absence of fat render the production of this outpouring of the blood easy, and permits a very considerable enlargement. The usual cause is external violence, a blow on the *scrotum* and the like; also a wound in which the bleeding vessel cannot be tied may give rise to it. That severe compression of the abdominal walls whilst the breath is held should cause hæmatocele is unlikely. According to the size of the injured vessel is the hæmatocele more quickly or slowly formed. The colour of the swollen *scrotum* is more or less violet or dark, and the swelling, although tense, is usually not painful. Similar ourpourings of blood, in women, occur in the *labia*.

[This form of the disease, Pott says, "consists in a rupture of and effusion of blood from a branch of the spermatic vein in its passage from the groin to the testicle. In which case, the extravasation is made into the *tunica communis*, or cellular membrane investing the spermatic vessels." (p. 385.) Upon this point Brodie justly observes:—"The tissue here (the cellular tissue of the *scrotum*) is exceedingly loose as in the eyelids, and slight injury will rupture vessels and produce *ecchymosis*; but the name of hæmatocele is here improperly applied." (p. 927.)]

1863. This outpouring of blood, although it may be considerable, generally disperses by antiphlogistic treatment, cold applications, the testicle being at the same time supported with a bag truss, and rest being enjoined. If this do not happen, and the swelling become more considerable, the collected blood must be discharged by several deep cuts, the bleeding vessels sought for and tied; or if this be not possible, the bleeding must be stanched by inserting lint moistened in some astringent wash, and by applying a close fitting bag truss.

(*a*) Outlines of Human Pathology, p. 561. London, 1836. 8vo.

1864. The hæmatocele which arises from a collection of blood in the vaginal tunic of the testicle is either consequent on a wound of a vessel of that tunic in puncturing a hydrocele, or of the tearing of swollen vessels which, in the quick drawing off the water, are suddenly deprived of their accustomed pressure, or it may arise from a bruising of the *scrotum*. In the former case the swelling in general arises soon after the puncture, in the second it is more tedious. The *diagnosis* is in other respects easy. In the third case the swelling has a resemblance to hydrocele; it, however, generally arises more quickly, and is not transparent. If the blood be partially coagulated, the swelling may, on account of its finer and irregular character, be mistaken for a sarcocele. Not unfrequently a hæmatocele of distinct portions occurs without violence, but from transudation of blood, especially in gravel, and cannot be distinguished from a hydrocele; or there may be a bloody exudation with varicosity of the vessels in old and very large hydroceles, in degeneration of the vaginal tunic and so on, which is only discovered in the operation for hydrocele. Sometimes in old persons mortification and death quickly follow (*a*).

[Brodie says :—" Hæmatocele most frequently occurs in combination with hydrocele, the blood being mixed with the fluid contained in the *tunica vaginalis*, and partially dissolved in it. If the quantity of blood be small, which is most frequently the case, the solution is complete; but when otherwise, *coagula* are formed, which remain undissolved." (p. 927.) Upon this point I must observe that I do not recollect to have seen a single instance in which hæmatocele followed the operation for hydrocele, though I am well aware that the disease is occasionally so produced, in consequence of the trocar wounding the testicle, if the vaginal tunic be thick and rather more than ordinary effort be used for its introduction; but I have never seen such a case, though I have seen many of hæmatocele produced by a blow.—J. F. S.

Brodie mentions a remarkable " case, where the extravasation was so great that the *tunica vaginalis* was ruptured, and the blood escaped in large quantity into the cellular membrane of the *scrotum*." (p. 927.)

Astley Cooper mentions the case of " a gentleman who had a large pyriform swelling in the left *tunica vaginalis*, which had never been painful, and which had an obscure fluctuation, but was not transparent. He made an incision into it, and discharged near a pint of fluid blood. This swelling had not succeeded a blow, but was imputed to excessive exertions which this gentleman had been in the habit of making." (p. 214.)]

1865. Outpouring of blood into the vaginal tunic is rarely dispersed. Cold resolving applications and the treatment above advised (*par.* 1863) may be attempted, but if of no advantage, the vaginal tunic must be opened, the blood discharged, any wounded vessel tied, and in a decided hydrocele the necessary treatment may lead to a radical cure (1).

[(1) Upon this point Chelius is in error, so far as I have had opportunity of observing these cases, as the blood is generally absorbed without difficulty in the course of two or three weeks. The contrary is the exception.—J. F. S.

Of the length of time which a hæmatocele may exist without causing trouble Astley Cooper relates a remarkable instance, in which a hæmatocele " as large as the double fist had existed seventeen years, had not been attended with any pain, and its size and weight were the only inconveniences it produced. Its cause the patient attributed to a blow, in hunting, from the pummel of the saddle, which gave him great pain for a short time. The *testes* and *epidymis* could be felt at the lower part of the swelling, and above it to the ring, a solid substance united with a fluid could be perceived. It was not in the least transparent, and he had never suffered pain in it. The swelling was opened, a coffee-coloured fluid, blood and solid substance of a brownish-yellow colour was discharged, the *tunica vaginalis* was excessively thickened, looking like the densest parchment." In the course of the same day, after riding home in a coach, " he was seized with a profuse hæmorrhage from the *tunica vaginalis*, and fainted.

(*a*) Exercitationes Pathologicæ, p. 201.

Much constitutional excitement followed, clots of blood and profuse purulent discharge ensued, and after six weeks he got well." (p. 210-12.)

More commonly, however, if the outpoured blood be not absorbed in a few weeks, it becomes an irritant, suppuration is set up within the vaginal tunic to get rid of it; the *scrotum* on that side becomes of a dusky-red colour, and more or less tender, and, if left alone, will sometimes point, and then clots of blood with bloody pus are discharged, and continue till the whole sac is emptied, when healthy suppuration follows, and the cavity of the tunic is obliterated. I have seen two or three instances of this kind. When its existence is suspected it is best to make a free cut from top to bottom of the vaginal tunic so as to empty its contents at once, healthy suppuration soon comes on, and the patient is cured.—J. F. S.]

1866. As to the outpouring of blood into the substance of the testicle, it is probable that it may be confused with some organic changes of that organ; and if, in consequence of a violent bruising, blood be extravasated within the *tunica albuginea*, and the above-recommended treatment, castration must be considered necessary.

[As the formation of hydrocele has been already shown (*par.* 1199, *note*) to take place occasionally in the spermatic cord, so does hæmatocele, ,as was noticed by Pott, who says:—"The last species of this disease (hæmatocele) arises from a bursting of a branch of the spermatic vein, between the groin and the *scrotum*, in what is generally known by the name of the spermatic process. This, which is generally produced by great or sudden exertions of strength, feats of agility, &c., may happen to persons in the best health. * * * The effusion or extravasation is made into the cellular membrane which invests and envelopes the spermatic vessels, and has something the appearance of a true hernia." (pp. 391, 92.) If discutient remedies be unavailing, Pott recommends the swelling should be cut into, and either the bleeding stanched with styptics, or, if the vessel be large, that it should be tied singly, and if that be insufficient, that even the testicle should be removed, and the whole end tied.

Curling says:—"An encysted hydrocele of the spermatic cord may beconverted into a hæmatocele. In the Pathological Museum of St. Bartholomew's Hospital there is a preparation of encysted hæmatocele of the spermatic cord. The cyst is empty, but it is described to have contained blood, and its walls are deeply stained with the colour of partially decomposed blood. Its lining membrane is wrinkled and coarsely granular, and the tissues around it are thickened, tawny, and adherent together. I lately examined a preparation in the Hunterian Collection, which I have no doubt is a specimen of old encysted hæmatocele of the spermatic cord. There is a good sized cyst, lined by a membrane, polished, and a little wrinkled, filled with a soft tawny-looking granular matter, resembling the altered coagulum of blood which I have observed in ordinary hæmatocele after long maceration in spirit. The tissues around the cyst are thickened and indurated, just like those around an old hæmatocele of the testicle." (pp. 249, 50.)]

III.—OF OUTPOURING OF BLOOD INTO THE CAVITIES OF JOINTS.

1867. A collection of blood in the cavity of a joint occurs rarely, and is only the consequence of a violent bruise or wrench of a joint, or of a wound, if the blood cannot escape through the outer opening. The quick occurrence of the swelling after one of the above-mentioned causes, distinguishes it from other swellings.

[Hey (*a*) mentions an instance of blood getting within the capsular ligament of the knee-joint in consequence of a wound, but no harm followed, and it was absorbed without having caused any inconvenience.]

1768. The *treatment* consists in the use of cold applications, general and local antiphlogistic remedies, by which dispersion is effected. In other respects the rules laid down (*par.* 557 and onwards) must be borne in mind.

(*a*) Practical Observations on Surgery, p. 354.

THIRD SECTION.—COLLECTIONS OF DISEASED PRODUCTS.

I.—OF DROPSY OF THE MUCOUS SACS.

(*Hydrops bursarum mucosarum*, Lat.; *Wassersucht der Schleimbeutel*, Germ.; *Hydropisie des Bourses muqueuses*, Fr.)

KOCH, C. M., Untersuchung des natürlichen Baues und der Krankheiten der Schleimbeutel. Nürnberg, 1795. 8vo.

MONRO, ALEXANDER, M.D. (*secundus.*) A Description of all the Bursæ Mucosæ of the Human Body, &c. Edinburgh, 1788. fol.

BRODIE, Sir BENJAMIN, Pathological and Surgical Observations on the Diseases of the Joints. London, 1834. 8vo. Third Edition.

SCHREGER, B. G., De Bursis mucosis subcutaneis; cum ix. tab. Erlang., 1825. fol.

MAYO, HERBERT, Outlines of Human Pathology, p. 110. London, 1836. 8vo.

1869. *Dropsy of a mucous sac* produces a swelling, fluctuating, peculiarly elastic, in general not, but sometimes very painful; most generally occurring on the hip- knee- ankle- wrist- elbow- and shoulder-joints, and having the skin over it of its natural colour. At first it is circumscribed, and does not extend over the whole joint; its extent, however, may be very considerable.

[MAYO says:—"The *bursa* situated between the *latissimus dorsi* and the inferior angle of the *scapula*, is liable to become distended with a very considerable quantity of fluid." (p. 111.) He also observes, that "pressure will cause the developement of subcutaneous *bursæ* in the cellular tissue, where they previously had no existence." (*ib.*) This is the comman opinion, but it must be taken with some caution, as the number of mucous bags just beneath the skin is much greater than commonly supposed, so that one of them originally existing, may only have become dropsical, and then first only have attracted notice. There seems, however, little doubt that they are actually produced sometimes, when a part is subject to great pressure.—J. F. S.]

1870. This disease may be produced by external violence, by spraining the joint, or by pressure; or by cold, rheumatic, gouty or scrofulous disease, and after the frequent use of mercury. The cause of the unnatural collection appears to be always an inflammatory condition of the inner membrane of the mucous sac, which corresponds in its physiological and pathological nature to synovial membrane. This inflammation is at first often very great, and appears to be related to the cause on which it depends. The fluid is mostly thin, sometimes more consistent, jelly-like, and often contains a great number of cartilaginous concrements, of whitish colour, smooth surface, and different size, often felt distinctly on examination of the joint, and made up of coagulated *albumen*. The membrane of the mucous sac is often very much thickened, and nearly cartilaginous. If the swelling be highly inflamed, it may run on to suppuration, the pus may be poured out beneath the skin, and considerable destruction and fistulous passages may ensue. This is very frequently the case upon the front of the knee-joint.

Undoubtedly here belongs a peculiar kind of encysted swelling, described by CRUVELHIER (*a*), which is most frequent on the front of the wrist, less so upon its back, and more rarely at the ankle-joint, but always occurring in the neighbourhood of synovial capsules and tendons, most commonly divided into two halves connected with, but beneath

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(*a*) Essaies sur l'Anatomie Pathologique en général, vol. i. p. 306. Paris, 1816.

each other, by an opening in the tracks of two neighbouring ligaments, and containing besides a quantity of serous or synovial fluid, a larger or smaller number, even up to a hundred, of oblong, smooth bodies, composed of numerous layers, from the size of an oat, to that of a bean.

The mucous sheaths of tendons are similar to mucous sacs, and the swellings developed in them, which contain a thin or more consistent fluid, (*ganglia*, Lat.; *Ueberbeine* Germ.; *ganglions*, Fr.,) must, at least the greater number of them, be classed with dropsy of the mucous sacs.

[Partial enlargements of the sheaths of tendons by the collection of a fluid like *synovia* within them, forming what are commonly called ganglions, sometimes occur in very uncommon situations; I have in one or two instances seen a ganglion as big as a pigeon's egg, and very hard, from its fulness, in the inner hamstring, just above the knee-joint. I have at present under my care, a young man, who after a little more than ordinary exertion, had a swelling come almost suddenly just where the tendon of the *m. sartorius* turns round the upper part of the shin-bone, and extending up into the ham, so as to have somewhat the appearance, at first sight, of a popliteal aneurysm, and nearly as large as a goose egg, tense and free from pain. In the course of a fortnight it subsided under the use of cold evaporating lotions.—J. F. S.]

1871. Among the dropsies of the mucous sacs, those are most frequent which are seated on the knee-cap; they are painless, without any alteration of colour in the skin, soft, elastic, compressible, of a spongy feel, mostly oval, and always distinctly defined, or they are bean-shaped, puffy, hanging down from the knee, or more elevated in breadth. However variously their extent may exceed that of the knee-cap, yet is their base, however, always alone confined to it, and has no other attachment; and although the mass itself be movable in every direction, yet the base can never be moved from this one spot. The fluid it contains is *serum*, in which are frequently similar little bodies, to those found in the mucous bags (1). SCHREGER (*a*) calls this swelling, which is usually known by the name of *Knee-fungus* (*Fungus genu*, Lat.; *Knieschwamm*, Germ.) or as *dropsy of the mucous sac on the head of the shin-bone*, an *encysted dropsical swelling on the knee-cap*, (*Hygroma cysticum patellare*, Lat.; *Wasserbalggeschwulst auf der Kniescheibe*, Germ.,) in which the serous fluid is contained in a space naturally existing upon the upper surface of the knee-cap, (*bursa subcutanea patellaris*,) but not in the mucous bag on the head of the shin-bone (*b*), or in the fine plates of the cellular substance (*c*), or in a newly-formed sac like a true encysted swelling (*d*). This swelling upon the knee-cap is to be classed with that seated on the *olechranon*, in the *bursa anconea*, appears mostly in old people, and in which the above-mentioned little bodies are observed in quantities. These two swellings, especially that on the knee-cap are often accompanied at first with violent inflammation.

The mucous sacs are capable of a degeneration in which an homogeneous, tough, moderately fibrous mass, connected with their walls, is formed, and gradually enlarges to an enormous size. I have noticed swellings of this kind on the knee-cap and at the elbow-joint, and have removed them successfully. All other treatment is useless.

[(1) This enlargement of the mucous bag upon the knee-cap is so very frequent among women servants, that it has acquired, and usually goes by the name of "Housemaid's knee." It is also extremely common to observe the same kind of enlarged bag upon the back of the *olechranon*, but without the person's elbow having been subject to any frequent pressure.—J. F. S.]

1872. The *treatment* must be guided by the circumstances of the swelling, and according to the causes with which it is related. Their

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(*a*) Chirurgische Versuche, vol. ii. p. 245.—Above cited, p. 38, pl. ii., iii.

(*b*) COOPER, SAMUEL, on the Diseases of Joints, p. 74. London, 1807.

(*c*) RUSSELL, JAMES, A Treatise on the Morbid Affections of the Knee Joint. Edin., 1802. 8vo.

(*d*) VON WALTHER; in his Journal für Chirurgie und Augenheilkunde, vol iv. p. 390.

dispersion is always the object, and if this cannot be effected, the discharge of the collected fluid and the growing together of the cavity of the mucous sac.

1873. If the swelling be inflamed and painful, cold applications of lead wash, leeches, and rubbing in mercurial ointment must be employed; afterwards when the inflammation has ceased, or the fluid still remains, blisters kept up for some time, or rubbing in volatile ointments. If the inflammation of the mucous sac be very severe, arising from mechanical influence on a previously painless swelling of the sac, and if the swelling be very great, then usually all dispersive remedies are useless, and it must be cut into to prevent the spreading of the suppuration. Serous fluid and floccy pus escape, and the treatment is to be the same as after opening abscesses. If the swelling be, as usual, painless, volatile rubbings, long continued blisterings, warm douche baths, dispersing plasters, and the like are employed, together with which those remedies are made use of which counteract the general ill condition of the constitution; among which I have found *vinum seminum colchici* of the greatest service, especially in gouty and rheumatic complaints (*a*).

1874. If by this treatment the dispersion be not effected, and the still increasing tumour cause inconvenience, it must be emptied by a puncture or a cut, and by the introduction of tents, by irritating the inner surface of the swelling with the blunt end of a probe, by injections especially of solution of iodine, by the insertion of a seton, or by a subcutaneous cut to produce such a degree of inflammation as will put a stop to all secretion (*b*). It must not, however, be forgotten that inflammation and suppuration of a large mucous sac may produce dangerous symptoms. If the walls of the sac be very much thickened, this mode of treatment can be of no service, and it may be necessary, if the situation of the swelling permit, to remove the sac either entirely or so that its hinder walls alone remain, and be thrown off by suppuration.

The treatment of encysted dropsical swellings on the knee-cap agrees precisely with what has been just laid down, except that HEISTER's prescription (*c*), consisting of litharge ℥vj., Armenian bole ʒj., mastic and myrrh of each ʒiv., and vinegar a pint, boiled together for a quarter of an hour, and applied to the swelling on a folded cloth, four or six times a day, and keeping the patient quiet, with a moderately tightly applied bandage, will in most cases produce either the cure at once, or after the swelling has been punctured.

In the encysted swellings, (*par.* 1870,) described by CRUVELHIER (*d*), it is not, according to DUPUYTREN, sufficient merely to open them with one puncture, but two should be made, and a seton introduced. It may, however, be sufficient in most cases, to open the swelling on both sides, and to use irritating injections, as the irritation of the seton may produce very violent inflammation and fatal symptoms.

According to LENOIR (*e*), three mucous sacs are found on the sole of the foot, one under the heel-bone, an inch in length, the second on the under surface of the joint of the great toe, between the skin and sesamoid bones, and the third on the little toe at the same part, with a lengthening on the outer edge of the foot. The dropsy of these mucous sacs or their inflammation, with the serous exudation, may be easily taken for abscesses. If opened, they readily become fistulous, produce ill-conditioned pus, and are covered with a thickened epidermis. In inflammation, a corresponding antiphlogistic treatment, poultices, cuts, cauterization, or excision must be employed.

(*a*) GIERI, J. M.. Medicinisch-Chirurgische Beobachtungen. London, 1807.

(*b*) Upon cutting into these swellings beneath the skin and into ganglia especially, see BARTHOLEMY, CHAUMAT, MARECHAL; in Gazette Médicale de Paris, vol. vii. p. 773. 1839.—MALGAIGNE; in Bullet. de Thérapeut. 1840, p. 29.—THIERRY; in Gaz. Méd. de Paris, vol. ix. p. 537, 1841.—HENNEMANN, Ueber eine neue Reihe subcutaner Operationen. Rostock und Schwerin, 1843.

(*c*) Institutiones Chirurgicæ, vol. i. p. 344.—SCHREGER, above cited.

(*d*) Above cited, p. 323.

(*e*) Recherches sur les Bourses muqueuses souscutanées de la Plante du Pied, et sur leur inflammation; in Presse Médicale, vol. i. p. 48. 1837.

[I recollect seeing a case of the elder **Travers**'s in St. Thomas's Hospital, in which suppuration of the mucous sac upon the knee-cap came on very rapidly, and extended around the front and sides of the joint. The patient suffered severe symptoms of constitutional excitement, and I must confess I thought the suppuration was within the joint itself; he however thought otherwise, and directed the swelling to be freely opened; a large quantity of pus escaped, and the symptoms of irritation soon subsided. Union of the skin with the parts beneath did not, however, take place very quickly, and when all was quiet, the introduction of a probe, which ran along freely immediately beneath the skin, showed that **Travers**'s opinion was correct. She recovered perfectly, and with full use of the joint in a comparatively short time.

Irritation of the inside of these dropsical sacs by poking with a probe, setons or injections, are on no account to be resorted to, as the very probable consequence will be severe inflammation, terminating in gangrene of the sac and neighbouring parts, and high constitutional disturbance.

Occasionally it happens after the mucous sac on the knee-cap has suppurated, and either burst or been opened, that it takes on a fistulous character, and two or three or more little wounds ulcerate through the skin, which are very plaguing to the patient, and very troublesome to heal. Under these circumstances it will be found very advantageous to stuff in a little red precipitate powder, and apply ointment of the same with a bandage, keeping the patient at rest at the same time.—J. F. S.]

II.—OF DROPSY OF THE JOINTS.

(*Hydrops Articulorum, Hydrathrosis*, Lat.; *Gelenkwassersucht*, Germ.; *Hydrarthrose*, Fr.)

1875. *Dropsy of a joint* is a collection of serous fluid within the capsular ligament, by which it is distended into a swelling, soft, bounded by the attachments of the ligament yielding to the pressure of the finger, but without retaining any impress, distinctly fluctuating, little or not at all painful, and upon which the skin is unchanged. The swelling does not entirely correspond with the whole extent of the joint, but is greatest where the capsular ligament is most yielding and little covered. Thus, for instance, a swelling at the wrist-joint is especially distinct on its fore and hind surface, but is scarcely perceptible on its sides; at the ankle-joint it is most remarkable on the front; at the shoulder it confines itself to the front, and projects most distinctly between the deltoid and great pectoral muscle. At the knee-joint, where the disease most commonly occurs, the swelling appears in front and at the sides, when very large projects most on the inside, is divided into two parts by the knee-cap and tendon attached to it, and extends upwards beneath the muscles of the thigh. The knee-cap is thrust forward, is very movable, and after being pressed down, again rises when the pressure is removed. When the leg is bent, the swelling on the sides is larger and more tense; when the leg is extended, the fluctuation is more distinct. The movements of the limb are little interfered with in dropsy of the joint.

1876. The disease in general is slowly developed. Its *causes* may be external violence, bruisings, sprains, catching cold, rheumatic or arthritic attacks, cartilage-like bodies in the joint, and *metastasis*, whereby a slow inflammatory condition and disproportion between the secretion and absorption of *synovia* is produced. The collected fluid does not differ from common *synovia*, except that in long continuance of the disease it becomes more consistent, viscid, and of a tawny colour.

In most cases where the parts of the joint are organically altered, swelled up, thickened, ulcerated, or affected with *caries*, collections of *mucus*, or *pus*, are formed in its cavity. This condition, which has been by some described as complicated dropsy of the joint, requires only particular attention, if the disease which had produced it diminish, in which case, if the absorption of the collected fluid have not taken place under the above-mentioned treatment, (*par.* 213 and onwards,) it may require to be discharged, which I have several times done successfully at the knee-joint.

[Brodie (*a*) observes:—" Cases occasionally (but not often) occur, in which a joint is swollen from a preternatural quantity of fluid collected in its cavity without pain or inflammation. This may be supposed to arise, either from a diminished action of the absorbents, or an increased action of the secreting vessels. The disease may be compared to the dropsy of the *peritonæum* or *pleura;* or more properly, to the hydrocele; and it has been not improperly designated by the terms *Hydrarthrus* and *Hydrops Articuli.*" (p. 7.)]

1877. The *prognosis* in dropsy of a joint is usually not favourable, unless when it have arisen quickly, and have not been of long continuance, in which case its dispersion may be often easily effected. But if the disease have existed any length of time, and be very considerable, and if the ligaments have thickened, the hope of a dispersion is very slight, and puncturing the joint for the purpose of discharging the collected fluid, is an operation which may lead to the most dangerous consequences. Dropsy of a joint is also easily liable to a relapse, and when long continued, can produce organic changes of the joint, which build up new structures.

1878. The *treatment* of incipient dropsy of a joint is the same as that directed for inflammation of the synovial membrane. If the disease have existed some time, it must be the object to encourage the absorption of the collected fluid; frequent rubbing, rubbing in volatile ointments, mercurial ointment with camphor, repeated blisters frequently and at different parts applied, and long persisted in, fumigations, warm and cold douche baths, wrapping up in oiled silk, the moxa, the actual cautery, electricity, and moderate compression. The internal treatment must correspond to the cause of the disease. Gimelle (*b*) has recommended large doses of tartarized antimonial wine as especially efficient.

1879. If the absorption of the collected fluid be not brought about by this treatment, if, on the other hand, the quantity increase, so that great pain and inability of using the limb be produced, or if there be also a foreign body in the cavity of the joint, the collected fluid must be so discharged as to prevent the entrance of the air. With this object the fluid is to be pressed against that part of the joint where the coverings are thinnest, on the knee for instance, on the inside. With the fingers of the one hand the skin is to be drawn aside, and a thin trocar, a lancet, or a bistoury, thrust into the joint, without, however, wounding the joint surfaces. After the discharge of the fluid, and the removal of the canula, if the trocar be used, in doing which the wound is to be closed with the thumb of the right hand, and the coverings held back with the fingers of the left, the skin which has been drawn aside is allowed to return to its place, so that the parallelism between the outer and inner wound is got rid of, and the wound well closed with sticking plaster.

Opening the swelling with a lancet, or bistoury, is preferable to that with the trocar, if the fluid be very thick, or if there be any little bodies at the same time present in the joint, of which the removal is also requisite.

[I can hardly think the operation of puncturing a dropsical joint is, under any circumstances, justifiable, as the inflammatory symptoms which follow a wound of the synovial membrane, even when healthy, are generally so great, and the consequences

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(*a*) On the Diseases of Joints.

(*b*) Gazette Médicale de Paris, vol. viii. p. 445. Paris, 1840.

so serious, and sometimes fatal, that the patient's life ought not to be endangered by such treatment. And should this practice even succeed, it is only useful for a time, as the fluid will recollect. As to the use of injections, after emptying the joint of its contents, as advised by VELPEAU, and presently to be mentioned, I think it cannot be too much deprecated, and I doubt whether any English Surgeon would risk his reputation, and the safety of his patient, by a practice which must be attended with almost certain mischief.—J. F. S.]

1880. After the operation the patient must be kept quiet for ten or twelve days, and the part bathed with cold lead wash. If pain and inflammation arise, the rules recommended for wounds of joints must be followed. If these symptoms do not occur, or when they have been put aside, all those remedies must be employed, after the healing of the wound, which are capable of restoring the due relations between the secretion and absorption of the synovial fluid.

1881. The simple puncture of the dropsy of a joint rarely ever indeed produces a radical cure, as the fluid re-collects more or less quickly, and besides severe symptoms and suppurative inflammation may ensue.

To effect a radical cure, BONNET (*a*) has employed successfully in dropsy of the knee-joint, injections of iodine; and the same has been also practised by VELPEAU (*b*). After the leg has been stretched out, an assistant places his hand on one side of the joint, for the purpose of pressing the fluid towards the other, at which the puncture is to be made. The outer or inner side of the joint above the knee-cap may be chosen. The skin is then to be raised in a fold, the base of which is punctured with a trocar, which must be thrust in at least three-quarters of an inch, and so deep as that its point shall touch the front surface of the thigh-bone. A viscid transparent fluid escapes through the canula, of which only from five to seven drams is to be drawn away, that is, about a similar quantity to the quantity of fluid presently to be injected. The canula is always to be directed upwards, so that it remain full of fluid, and therefore in the injection the air is more certainly excluded. Various solutions of iodine may be used as injections; BONNET, however, especially prefers a solution of half a dram of iodine and one dram of iodide of potash, in four drams of water (1). The quantity of fluid injected must not exceed that drawn off, and therefore, in dropsy of the knee-joint, never more than from four to five drams of fluid should be thrown in. After the injection has been made, and the canula carefully withdrawn, the puncture must be covered with sticking plaster, the limb laid in a tray, and kept perfectly still. The consequence of the injection is an acute inflammation, the running on of which to suppuration must be carefully prevented. In very great and painful swellings of the joint, from the excessive collection of fluid, it may be necessary to discharge part of the fluid by puncture, so as to lessen the symptoms.

[(1) If there be no mistake in the proportions given for this injection, which unfortunately I have not the opportunity of verifying, it must be highly caustic, and such as no English Surgeon, I think, would dare to throw into a joint, though a French Surgeon might.—J. F. S.]

(*a*) Mémoires sur les Injections iodées dans les Hydropisies et les Abcès des Articulations; in Bulletin général de Thérapeutique, p. 340. Nov., Dec. 1842.—MARTIN, (Thèse,) Du Traitement des Maladies Chroniques des Articulation par des Injections irritantes. Strasbourg, 1842.

(*b*) Gazette Médicale de Paris, vol. x. p. 651, 1842, Oct.

III.—OF LYMPH SWELLINGS.

These have been considered in *par.* 15–18, *par.* 59–62.

IV.—OF WATER IN THE HEAD, AND CLEFT SPINE.

(*Hydrocephalus,* Lat.; *Wasserkopf,* Germ.; *Hydrocephale,* Fr.;—*Hydrorachitis,* seu *Spina bifida,* Lat.; *Rückgrathswassersucht oder Gespaltene Rückgräthe,* Germ.; *Hydrorachis,* Fr.)

1882. The term *water in the head*, or *watery head*, is usually applied to a collection of serous fluid beneath the coverings of the skull, between the skull and the brain, or in the cavities of the brain itself. According to these circumstance, it is distinguished into external watery head, (*Hydrocephalus externus*,) internal watery head, (*H. internus*,) and dropsy of the ventricles (*Hydrops ventriculorum cerebri.*)

1883. In *external watery head* the fluid may be either in the cellular tissue beneath the skin, beneath the *galea aponeurotica*, or beneath the *pericranium*. In the first case, the swelling spreads more or less over the whole head, often over the eyebrows, retains the impress of the fingers, and is specially characterized as *œdema*. In the second and third cases, be the swelling more or less spread, yet it never reaches to the eyelids. It is incorrect to apply the term *hydrocephalus* to this disease. It requires merely the ordinary treatment of *œdema*, the use of dispersive applications in connexion with rubbing and moderate compression, and if these be insufficient, the discharge of the fluid by cutting into the swelling.

Whether a partial collection of water under the *galea aponeurotica* actually exist, in which the swelling depending on it may be confused with other diseased conditions, has been already doubted.

1884. The *collection of water within the cavity of the skull* appears alone to deserve the name *hydrocephalus*. The collection of water between the membranes of the brain and the skull, is most properly distinguished as *hydrocephalus externus*, and that in the ventricles of the brain as *hydrocephalus internus*, or *hydrops ventriculorum*. Both conditions may agree together in being *congenital vices of formation*, the consequence of the staying of the *fœtus* at an earlier stage of development. *Hydrocephalus*, however, is frequently first developed at a longer or shorter period after birth, and mostly without any very decided cause. The watery head now to be considered may be distinguished as *hydrocephalus chronicus*, from *hydrocephalus acutus*, which quickly ensues, in consequence of inflammation.

The primary existence of external *hydrocephalus* is indeed denied by many, and it is asserted that the water only reaches the surface of the brain by a tearing of the cavities (*a*); it is, however, possible, that the water may be originally secreted as well on the outer as on the inner surface of the brain (*b*); for according to Magendie's (*c*) observation, there is naturally a watery fluid between the arachnoid coat and the vascular coat of the spinal marrow, which communicates with the ventricles of the brain by an opening in the bottom of the fourth ventricle. The same applies to the fluid between the *membrana arachnoidea* and *pia mater* upon the surface of the brain. External *hydrocephalus* is at all events a rare circumstance; it is not easily distinguishable from internal *hydrocephalus,* and resembles it in its symptoms, and the treatment it requires.

(*a*) Monro, Observations on the Eye, the Ear, and the Brain, p. 38.

(*b*) Meckel; Handbuch der pathologischen Anatomie, vol. i. p. 263.

(*c*) Journal de Physiologie, vol. vii. p. 1. 1827, Jan.

1885. In the congenital internal *hydrocephalus*, which is developed at no very determinate period of pregnancy, as also in that occurring afterwards, the walls of the brain are considerably distended by the collection of water in the ventricles, are thinned, and the convolutions unfolded; the partition of the ventricles (*septum lucidum*) is destroyed, and their internal lining generally thickened; yet, however, with this great thinning and as it were membranous extension of the brain, its gray and medullary substances are still distinguishable. In proportion as the collection of water becomes greater, the still yielding and not yet firmly connected skull-bones spread out, and the head acquires an enormous size. It is uncommonly broad, especially in the region of the ossifying points, because the bones, specially those on the sides, are thrust asunder by the water. The face has no longer an oval, but a triangular form, the forehead projects considerably over the orbits, and there is a remarkable disproportion between the size of the face and skull. The skull-bones form slowly, and are connected only by a number of intermediate bones. The membranes enclosing the water are not unfrequently torn during labour, the water discharged, and the coverings of the destroyed brain, for the most part, fall together.

1886. If in great distension of the skull some parts be more yielding than others, or the water sink from the fourth ventricle, between the *pia mater* and *tunica arachnoidea*, into the canal of the spine, by which the cartilaginous plates forming, previous to its perfect ossification, the hind portions of the *vertebræ* are outspread, there are produced elastic fluctuating swellings covered with a thin, sometimes transparent, skin, of various size, and forming the disease called *Cleft Spine* (*Spina bifida.*) These may be diminished by compression, upon which ensue *coma*, convulsions, palsy, and the like, Several such swellings may occur at the same time, so that the fluid may be driven from one to another. Their base is sometimes broad, sometimes has a neck, and on examination with the finger the edge of the opening in the bone, by which the fluid escaped, is felt distinctly, its shape round and regular on the skull, and oblong on the spinal column, where it is formed by a double row of spinous processes. These swellings may be seated at any one part of the skull, where the bones are separated by the sutures, especially on the forehead, on the sides, and on the back of the head; sometimes several exist together. These swellings are noticed in the spine, most commonly in the lumbar region, more rarely in the back and neck. Very rarely do several exist at the same time in the spine.

If a close connexion and co-existence be assumed between internal *hydrocephalus*, watery bags on the head and cleft spine, (*hydrorachitis, spina bifida,*) which opinion is confirmed on numerous grounds, it cannot, however, be denied that a primary collection of water in the membranes enveloping the spinal marrow, may exist without water in the head. Although the seat of the water be not always the same, it is, however, probable that it most commonly collects between the vascular and arachnoid coats. (*par.* 1884.) GALL noticed an example in a child eighteen days old with a cleft of the second, third and fourth lumbar *vertebræ*, and a collection of water within the arachnoid coat; and in the whole length of the spinal marrow, two lateral, smooth, slightly distended canals, which were perfectly closed, and entirely unconnected with the collection of water (*a*).

[(1) A very good case of the watery sac here described, is given by CHESMAN, of Sheffield (*b*), in a child three years and a half old:—" Over the left frontal protube-

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(*a*) Compare ACREL; in schwed. Abhandl. vol. x. p. 291.—DELPECH, Précis Elémentaire, vol. iii. p. 166. — TROMPEI, B.; in OMODEI's Annali Universali di Medicina, vol. xv. 1820. Lugolio.

(*b*) Prov. Med. and Surg, Journ., vol. vii. 1844.

rance was a tumour of the size of a large orange, membranous, but having in its centre a small portion of thin bone. This membrane arose from a projecting portion of bone, almost circular, whose diameter was three inches and a half, and contained about half a pound of serum; when this was suppurated, it appeared as if there was a shell of bone below, which was not complete, as the fluid run from this cell into the cavity of the skull. The roof the orbit was nearly convex. On puncturing the right side of the anterior fontanelle, about five pints of serum were drawn off. The body was of a rickety appearance and much emaciated, and there was a *spina bifida* of the size of a hen's egg in the lumbar region. The child had possessed all its faculties until a day or two previous to its death, but generally lay on a sofa with its head raised. Until five months of age the head had been normal, but then increased." (p. 564.)]

1887. The mischiefs produced by *hydrocephalus* and *spina bifida* in the functions of the brain and spinal marrow, are not always the same. Most commonly children born with water in the head die soon after birth, either in consequence of the disease itself, or the damage which the head suffers during delivery; in rare cases, however, they reach a more or less advanced age, and the head acquire an enormous size. Notwithstanding the diminished size of the brain, its functions are not always proportionally lost. Although the functions of the intestinal canal be in general natural, the nourishment of the body otherwise is affected, so that it is extremely thin and backward in its development. In those cases in which *hydrocephalus* is accompanied with watery bags, the abovementioned mischiefs are usually slighter, and scarcely observable. In *spina bifida*, indeed, the condition of the spinal marrow is, for the most part, altered; it is thinner, is dissolved into a watery substance, studded with watery bladders, and at the seat of the cleft entirely deficient; it is, however, rarely altered further than at the seat of the cleft, and not always in the same degree. Symptoms of *hydrocephalus* usually accompany *spina bifida*, great wasting, weakness of the lower limbs, involuntary discharge of the urine and stools, spasms, convulsions, and so on. The larger the swelling, and the nearer it is to the head, the more violent generally are the symptoms. Mostly children so affected die soon; they, however, in rare cases, live a shorter or longer time. With *hydrocephalus* and with *spina bifida* other misformations are frequently connected, for instance, hare lip, cleft palate, club foot, and the like, whence it decidedly follows that they must be considered as the consequence of an arrested development (*a*).

FISHER's (*b*) observations on the origin of *spina bifida* are very interesting; he found in two cases a *union of two or more sacral ganglions, the passage of their respective nerves through the sheath in one bundle*, and *the union of the end of the spinal marrow with the walls of the sac.* I have fully verified this statement, in a case in which death followed some time after puncture. FISHER hereon founded the following opinions:—*first*, that the union of the sacral ganglions depended on primary irregularity, from which arose the anomalous division of the corresponding nerves between the ganglions and the spinal marrow; *second*, the growing together of the spinal marrow with the sheath prevented the ascent of the marrow in its natural position, and to it is to be ascribed the irregular way in which the nerves are inserted into the spinal marrow; *third*, the union of the ganglions may, in a degree, be ascribed to the development of a process, by which the neighbouring ganglions, in many cases, themselves of natural form, unite with each other; and the general existence of this deformity at the lower part of the spinal column depends on the relative position of the sacral ganglions which lie in the sacral canal, whilst those of the other spinal nerves are in the intervertebral holes; *fourth*, the incomplete form of the hinder wall of the vertebral column is rather to be

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(*a*) MURRAY, J. A., Progres. de Spinæ bifidæ ex mala ossium conformatione initio. Goeting., 1779.

MECKEL, above cited.—FLEISCHMANN, De vitiis congenitis circa thoracem et abdomen. Erlangen, 1810.

(*b*) London and Edin. Philosoph. Magazine and Journal of Science, vol. x. p. 316, p. 886. 1837.

ascribed to the influence of the irregular development of the corresponding parts of the nervous system, than to a peculiar tardiness in the process of ossification.

[HEWETT (*a*) observes, in regard to *spina bifida*:—"The connexion which generally exists between the chord or the nerves and the walls of the sac, is a point of the utmost importance. Some cases are related by various authors, in which neither the chord nor the nerves had any connexion with the sac; these parts followed their usual course down the spinal canal; but in by far the greater number of cases that have been placed upon record, the nerves presented some kind of connexion with the sac. Of *twenty* preparations of *spina bifida*, occupying the lumbo-sacral region, which I have examined in various collections, I have found but *one* in which the nerves were not connected with the sac." (p. 461.)]

1888. As to the *treatment* of these two complaints, it has been advised to employ mercury internally and externally, repeated purgations, long-continued blisters, issues, setons, and a due pressure of the whole skull with bandages or sticking plaster (*b*). The unsuccessful result, after drawing off the water by puncture, or after spontaneous bursting, had discouraged this practice till more recent observations had shown, that by small stabs with a needle or a fine trocar, the fluid might be repeatedly emptied. In a few cases only, however, was a cure thereby produced, as with the often repeated puncture and simultaneous use of moderate pressure, at last fatal inflammation ensued. Besides, in the critical examination of these cases, it is proper to bear in mind that the operation is only performed when the distension of the skull is very considerable. An earlier employment of the puncture, by which the fluid can be gradually emptied, and the head at the same time properly compressed with a bandage, may perhaps allow the hope of a favourable result; but especially when the water in the head has not been congenital (1). The place for the puncture may be chosen at any part between the separated bones where there is no *sinus*. ASTLEY COOPER has recommended a palliative treatment, which has had good results, by means of a bandage which completely keeps back the swelling in *spina bifida*, and which must be continued for some time (2).

[(1) Dr. JAMES COPELAND (*c*) has very carefully analyzed and compared the cases in which the operation of puncturing the brain for chronic *hydrocephalus* has been practised, and his opinion upon the subject is entitled to serious attention. He says:—"From much experience I conclude that inflammatory irritation of the brain and its membranes does follow the operation in some instances; that the state of these parts and of the system favours its occurrence; and that the encephalic structures are in a very different condition in this disease, both mechanically and vitally, but especially as to proneness to inflammatory action and softening, from what they are in health. Whilst, therefore, I so far agree with those who argue for the operation as to advise it to be tried after the measures I have detailed have failed, yet I would not recommend its performance *early* in the disease; *first*, because medical treatment has then sometimes effected a cure, especially when the head has not been very greatly enlarged; and *secondly*, because, when the fluid is in the ventricles, as it generally is in cases commencing after birth, a greater depth of brain must be penetrated to reach it at an early than at a later period. When punctures are resorted to medical treatment must not be abandoned, or even relaxed; for we should still endeavour to remove the disposition to effusion, as well as to promote absorption; and as a certain degree of pressure is requisite to the healthy performance of the cerebral functions, strips of plaster should be applied around and over the whole scalp, in order to prevent the collapse consequent upon the operation. I believe that the punctures ought not to be frequent, nor much fluid withdrawn at one time; that gentle pressure should be made around the *cranium* during the dis-

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(*a*) Cases of Spina bifida, with Remarks; in London Medical Gazette, vol. xxxiv. 1844.

(*b*) BLANE, GILBERT, M.D., On the effect of mechanical compression of the head as a preventive and cure in certain cases of Hydrocephalus; in his Select Dissertations, p. 380. London, 1822. —BARNARD; in London Med. Repository, vol. xx. p. 314. 1823.

(*c*) Dictionary of Practical Medicine,—Art., *Chronic Dropsy in the Head*, vol. i. Lond., 1844. 8vo.

charge; that the discharge ought to be stopped, and the puncture accurately closed, so as to prevent the entrance of air, as soon as the pulse begins to sink; and that restoratives should be exhibited in order to prevent convulsions or other nervous symptoms. The operation seems to be best performed by a small trocar or grooved needle, but it is difficult to withdraw any fluid with the latter, as the surrounding pressure fills up the groove. The application of a cupping glass may, however, produce a discharge. A pointed thin trocar, with a two-edged lancet-shaped extremity, not a thick triangular instrument, is preferable upon the whole." (p. 683.)

(2) This is not quite correct. Abernethy first suggested the trial of slight pressure on the swelling of *spina bifida*, even from the first, so as to excite absorption and to prevent the distension of the unsupported *dura mater*. He also first punctured a case of this sort, which was hopeless, and repeated it every fourth day for six weeks, during which time the wounds healed regularly, and the child's health remained undisturbed. But at last the plaster slipped off, the wound ulcerated, suppuration ensued, and the child died. Astley Cooper first practised pressure, and afterwards puncture with a fine needle and pressure. In two of his cases the patients were alive and healthy, the one twenty-eight and the other twenty-nine years after this treatment.

Hewett lays down two good general rules in regard to puncturing *spina bifida*, according to Astley Cooper's method. "*First.* The tumour ought never to be punctured along the mesial line, especially in the sacral region; for it is generally at this part that the cord and its nerves are connected with the sac. The puncture is to be made at one side of the sac, and at its lowest part, so as to diminish the risk of wounding any of the nervous branches. *Second.* The instrument ought to be a grooved needle or a small trocar; for if a lancet be used, there will be great risk of wounding some important part contained in the cavity of the tumour." (p. 463.)

Compare, on the Surgical treatment of Hydrocephalus and Spina bifida—

Abernethy, John, An Account of Spina bifida; with remarks on a method of treatment. London, 1810.

Cooper, Astley; in Med.-Chir. Trans., vol. ii. p. 324. 1813.

Earle, Henry, Case of Hernia of the Dura Mater connected with Hydrocephalus internus; in Med.-Chir. Trans., vol. vii. p. 427. 1816.

Sherwood, H., in Medical Repository of New York, vol. i. p. 1. 1812.

Otto; in his Seltenen Beobachtungen. Breslau, pt. i. p. 66. 1816.

Hayes, Pliny; in New England Journal, vol. i. p. 237.

Newendorff, De Spinæ bifidæ Curatione radicali. Lips., 1820.

Trompei, B., above cited.

Freckleton, in Edinburgh Med. and Surg. Journal, vol. xvii. p. 240. 1821.

Lizars, in same, p. 243.

Vacca Berlinghieri, above quoted, p. 251.

Probart, F. L.; in Lancet, vol. xi. p. 800.

Skinner, in American Journal of Medical Sciences, vol. xix. p. 139. 1837. In this case seventy punctures were made, and above four pints of fluid were discharged.

Conquest; in Cyclopædia of Practical Medicine, vol. ii. p. 478, is stated to have punctured hydrocephalus successfully in four cases out of nine. The largest quantity of fluid drawn at any one time was twenty ounces and a-half; the greatest number of operations in the same child five, at intervals of from two to six weeks. The largest total quantity of water removed was fifty-seven ounces.

Oppenheim, F. V. (*a*), has collected all the hitherto known cases of puncture, and one which he himself treated, and has determined the applicability of this operation.

1889. The nearly always unfavourable result of repeated punctures in *spina bifida* has recently led to various modes of treatment with a view to effect, by the removal of the sac, at the same time, a closure of the opening of communication with the spinal canal, as Dubourg (*b*), Tavignot (*c*) Beynard (*d*), have shown, with successful result.

(*a*) Ueber die Punktion des chronischen inneren Wasserkopfes; in Rust's Magazin, vol. xxiv. p. 34.—Lee, A.; in New York Medical and Physical Journal, 1828.—Marsden; in Lancet, 1830-31, vol. i. p. 648.

(*b*) Journ. de Méd. et de Chirurg. de Toulouse. 1839, Sept.

(*c*) Gazette Médicale de Paris, vol. ix. p. 481, p. 700. 1841.

(*d*) Ibid., p. 573.

According to **Dubourg**, the tip of the swelling is to be taken hold of, raised a little up, and a part of its base cut through with a straight knife, in such way as to form two flaps, which are brought down upon the spinal column, and without at first cutting into a middle string, which is generally felt, and is formed by the sheath of the spinal marrow. Immediately after the rest of the base is cut off, and now but little skin remains. The pressure of an assistant's finger should prevent the escape of the fluid and the entrance of the air. The edges of the wound are then to be united with two, three, or four hare-lip pins and the twisted suture. This operation is required when the swelling and the opening are of small size and the child's health otherwise good.

Tavignot seizes the swelling at its base with an instrument similar to a pair of forceps, before which he cuts off the projecting mass, and then unites the edges of the wound as in the former mode.

Beynard surrounds the base of the tumour with a spring, into which a ligature is introduced, and ties it up. The tightening of the ligature is gradually increased till the inner walls of the sac, brought into close contact, unite, after which it is cut off and the remaining suppurating part brought together with sticking plaster. If the tied swelling be very tense, a portion of fluid may be allowed to escape by puncture.

1890. Of these several modes of treatment that of **Beynard** seems preferable, as by it the too quick emptying of the fluid, and entrance of the air are prevented, the union of the applied surfaces more certainly effected, and the cutting off performed when union is produced. **Dubourg**'s method is, in reference to these points, to be considered the most severe and dangerous.

V.—OF THE COLLECTION OF SEROUS AND PURULENT FLUIDS IN THE CAVITIES OF THE CHEST.

Brandes, De Thoracis Paracentesi. Götting., 1791.

Gumprecht, De pulmonum abscessu aperiendo. Götting., 1796.

Andouard, De l'Empyème. Paris, 1808.

Pelletan, Mémoire sur les Epanchemens dans la Poitrine et l'Opération de l'Empyème; in Clinique Chirurgicale, vol. iii. p. 237.

Lancy, Mémoire sur les effets de l'Operation de l'Empyème; in Mém. de Chirurg. Milit., vol. iii. p. 442.

Duncan, Andrew, Contributions to Morbid Anatomy, No. IV. Empyema and Pneumato-thorax; in Edinb. Med. and Surg. Journ. vol. xvii. p. 322. 1821.

Delpech, Mémoire sur l'Empyème ou Pleurésie suppurée; in Memorial des Hôpitaux du Midi. 1829, June.

Mohr, B., Beiträge zu einer künftigen Monographie des Empyems. Kitzingin, 1839.

Sedillot, De l'Opération de l'Empyème. Thèse soutenue, &c. Paris, 1841.

Krause, A., Das Empyem und seine Heilung auf medicinisch und operativem Wege nach eigener Beobachtung. Danzig, 1843.

Townsend, R., M.D., Article *Empyema*; in Cyclopædia of Practical Medicine, vol. ii. p. 28. London, 1833. Large 8vo.

1891. If in the cavity of the chest serous fluid (*hydrops pectoris*, *hydrothorax*) or pus (*empyema*) collect, symptoms of compression of the lungs and heart are produced, similar to those already mentioned when treating of extravasation of blood and collection of air in the cavity of the chest. (*par.* 486 and onwards.)

1892. If the collection be only in one cavity of the chest, the patient can only lie on the diseased side, and the breathing is exceedingly difficult if he lie on the sound side; if the collection be on both sides he can only lie on his back with the upper part of the body raised. The ailing side is more distended, the ribs separated from each other, and their movements prevented. In consequence of the compression of the lung, and the immobility of the chest on one side, the healthy half of the chest must move more actively. Although the intercostal muscles and the external muscles of the breast be not inflamed, yet an œdematous swelling occurs at certain spots, at least these muscles feel thicker. This swelling often spreads itself further over the diseased side of the body. If there be much fluid collected, pulsation is communicated to it from the heart, so that it can be perceived to a great extent, though often very slightly, and sometimes not at all. The heart itself may, by the pressure of the fluid, be thrust to the other side, and even upwards. The *diaphragm* may also in like manner be driven downwards, often to such extent that a swelling is observed below the short ribs and in the upper region of the belly; the patient has therefore specially in the sitting posture, a sensation of weight and pressure on the *diaphragm*. A fluctuation in the chest is often observed, on examining the body, either with the ear alone or with the stethoscope, and especially absence of the respiratory murmur on that part, except at the root of the lung. A bleating noise, *ægophony*, is observed when the collection is not very great, but it is lost when that side of the chest is distended by the collection. It is most distinct at the lower end of the blade-bone opposite the nipple. On percussion the chest does not yield the usual hollow, but a dull sound. The symptoms of hectic fever, dry or moist cough, small pulse, puffiness of the countenance, œdematous swelling of the upper limbs, and the like, in a great or less degree, accompany these symptoms.

In measuring (*mensuration*) an unyielding band is to be applied in an exactly horizontal direction from the spinous processes of the *vertebræ* to the middle of the breastbone upon the sound and on the diseased side. PIORRY (*a*) has proposed to perfect this *horizontal* measure with a vertical one, for which purpose, whilst the patient sits or stands, the one end of a band is to be placed on the top of the collar-bone, near the shoulder, and the other on the last sternal rib near its tip.

TARRAL has proposed feeling the fluctuation. The patient must lie on the diseased side, one finger is then to be strongly pressed into the intercostal space, whilst another finger gives a short blow on the corresponding interspace, and at such distance that the direction towards the impressing finger shall be as much as possible perpendicular.

If the flat of the hand be laid upon the walls of the chest, a vibratory motion is felt on speaking, which, according to RAYNAUD, will not be perceived if there be effusion The mobility of the healthy, and the immobility of the diseased side in breathing, can also be observed by the feel.

Percussion affords us the most certain sign of effusion into the cavity of the chest, and discovers to us most of the changes in reference to its origin and course, its alterations and diminution. If effusion do not fill the cavity of the chest, it changes its place according to the varying position of the patient, and, in consequence of its gravity, falls to the most depending part of the chest. In the sitting posture it occupies the space between the hind part of the *diaphragm*, the spine, and the ribs. As this space is very narrow, a small quantity of the fluid can afford a dull sound to a pretty large extent. At the part corresponding to the surface of the fluid a clear pulmonary sound is observed. If the patient lie on his back, percussion gives a clear sound in front, but a dull one behind, and this also happens if the patient lie on his belly, or upon one or other side; the sound is always dull at that part to which the fluid sinks. If the whole cavity be filled with fluid, it cannot alter its situation, and the dull sound is observed at every part. In circumscribed effusion also, where bounded by adhesions, the dull sound remains at the one spot, whatever posture the patient may assume. If the sound become duller or more sonorous where previously it was not so, it may be presumed that the

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(*a*) Traité du Diagnostic, &c., vol. i. p. 570. Paris, 1831.

fluid has increased or diminished. If percussion at one spot constantly give sonorous sound, around which, according to the different posture of the patient, a sonorous and dull sound can be produced, it may be concluded that there is an adhesion of the lung at this spot. Percussion is able to decide with accuracy the pressure which the surrounding parts suffer by the fluid. Sometimes, after the fluid has diminished, a dull sound is observed opposite the lower part of the cavity of the chest, which depends on the false membrane that has formed there, or has been separated from the parts above. It is not ever easy to distinguish between an effusion into the *pleura*, from one into the *pericardium*. An effusion into the *pleura* cannot extend towards the front of the heart without arising behind nearly to the spine of the blade-bone; if, therefore, there be dull sound in the region of the heart without a rising of the fluid up to the point stated, it must be concluded that there is effusion into the *pericardium*.

Auscultation affords different results according to the variety of the circumstances. In slight effusion the respiratory murmur may be distinguished, but it is weaker, and seems at a distance from the walls of the chest; if the effusion increase, the respiratory murmur ceases completely. In collections of fluid at the depending part of the chest, where the upper part is free, the respiratory murmur may be felt below, and is perceived above. If the patient's position be so altered that the lower becomes the upper part, the respiratory murmur is heard on the former, where it was not heard, and it is no longer perceived where it previously had been. This stethoscopic sign is of the greatest importance. LAENNEC considers ægophony as the pathognomic sign of pleuritic effusion; but this sign is of no actual value, and by ægophony alone the operation of *paracentesis* must not be decided. If ægophony point this out, it can only be shown at one part of the chest in a certain extent, and in a sharp change in the patient's voice; in other respects it consists in a strong resonance of the voice, which is trembling and broken, but is not so distinctly transmitted to the ear as pectoriloquy. Ægophony, like the respiratory murmur, ceases in great collection, and in changes of its seat, according to the different posture which the patient may be placed in. The height of the effusion bounds the space above where it can be heard, above which the voice has its natural sound. This line of demarcation determines the addition to, and diminution of, the effusion. Coughing presents an analogous change in the voice: sometimes the voice is perceived at a distance with a peculiar change, to which has been given the name *vox senilis*, (*égophonie à distance*); but this sound may exist without effusion, it can therefore afford only a conjecture.

1893. Notwithstanding all these aids which can be brought to the close determination of the state of the cavity of the chest, it is not ever easy to distinguish pleuritic effusion with certainty. Inspection and mensuration have no actual value. In healthy persons, the one side of the chest, especially the right, is frequently more strongly developed than the other. Every circumstance by which the activity of the lung is restricted, favours the diminution of the size of the chest; the other cavity of the chest, in proportion as the lung becomes more active than the other, acquires greater size. According to STOKES's observation, the increase of the chest on the left side, as a sign of *empyema*, is of more value; upon the right side it is only of consequence when it exceeds half an inch. In other respects, the quantity of effusion cannot be determined by inspection and mensuration, as with a trifling distension of the ribs there may be considerable thrusting back of the *diaphragm* and *mediastinum*. The audible dashing of the fluid, when the patient is held and shaken by the shoulders, is only perceptible when the cavity of the chest at the same time contains air; it therefore often affords no sign except being very distressing to the patient, and the audible dashing must be distinguished from that resembling it, which can be produced by fluid in the stomach. I have, in one instance, fully distinguished the two kinds of dashing from each other. The sensible fluctuation is, according to TARRALL, perceptible only in a small number of cases, in very thin persons, and if the *pleura* be distended by a large quantity of fluid. The immobility of the chest may depend on many other circumstances. The vibratory movement does not, according to Raynaud, always exist, and all the diseases which prevent the entrance of the air into the lungs do not admit its occurrence. Percussion and auscultation usually give the most decided signs, though even they in many instances are uncertain. Thus a duller sound is observed in *pneumonia*; but it does not arise in this case so suddenly, or, so to speak, at once, as in effusion; on the contrary, it is gradually developed; at first weak and scarcely perceptible, it gradually becomes stronger in proportion as the inflammation more and more prevents the entrance of the air into the lung; but in the highest degree of hepatization of the lung, the dull sound is as distinct and complete as in effusion. The dull sound is generally circumscribed, rarely corresponding to the whole extent of the lung, as on the contrary it is not seldom that effusion occupies the whole of one cavity of the chest. In effusion the dull sound suddenly ceases above the level of the effusion, and gives place to a hollow sound: this is not the case in *pneumonia*, some cases of *pneumonia lobularis* perhaps excepted. Hepatization alone produces so dull a sound as can be mistaken for extravasation; but about a hepatized part of the lung there are always others, which are inflamed in a lesser degree, and which form a gradual transition from the diseased to the sound part. Percussion, therefore, carefully used, may give a dull sound, which *gradually* diminishes till that spot which corresponds to the healthy part of the lung be reached, where it is entirely lost. A further distinction between extravasation and *pneumonia* is, that in the former the seat of the dull sound varies according to the different posture of the patient, whilst in *pneumonia* it remains the same in every position. In extravasation the dull sound always first begins at the most depending part of the chest, whilst in *pneumonia* it is often first perceived at the upper part, as it often is situated at a higher part.

Hirtz (*a*), presuming that the physical phenomena vary according to the relation of the lungs to the outpoured fluid, determines these relations upon three conditions; *first*, when the effusion is small, some ounces up to a pound; *second*, if it be moderately great, from one to three pounds; and *third*, when it is considerable, three pounds and upwards. If the effusion be moderate, it varies, according as it is recent or of some time standing. In the former case the effusion spreads around the lung, which, as it were, is bathed in fluid; the pulmonary and costal *pleura* are separated from each other by a layer of fluid, the thickness of which is everywhere nearly alike. In from ten to fourteen days the fluid, however, sinks down, and thrusts the lung upwards, if it be not hepatized or adherent. A recent outpouring may be distinguished by the following signs:—breathing, voice, cough short, broken, faint bleating, and a dull sound to a great extent; in considerable effusion, the latter, but never the former symptom is observed. When the outpouring has existed for some time, the dull sound is perceived only to a trifling height, as the fluid sinks down; on the contrary, ægophony is deficient at the lower part, as for its production not merely is the fluid necessary, but that also a portion of the lungs should be surrounded by it. Above the collection a clearer sound is heard, and the respiratory murmur on auscultation. We are, therefore, led to suppose that the fluid has been absorbed, whereas, however, it has only changed its place, and sunk to the bottom. It may, therefore, be concluded, if with diminution of the dull sound, and a return of the respiratory murmur at the upper part of the lung, ægophony be wanting at the lower part, that the fluid has changed its place, and has not diminished. The phenomenon of the descent of the dull percussion-sounds, without diminution of the fluid, depends often less on the removal, than especially on the diminution of the size of the lung, in consequence of the pressure upon it (*b*).

(*a*) Archives générales de Méd., vol. i. 1837.

(*b*) Laennec, Traité de l'Auscultation médiate et des Maladies des Poumons et de Cœur, vol. i. p. 72, vol. ii. p. 230. Paris, 1826. Second Edition. —Piorry, Traité de Diagnostic et de Seméiologie, 3 vols. Paris, 1837. 8vo.—Stokes, Will., M.D., A Treatise on the Diagnosis and Treatment of the Diseases of the Chest. Dublin, 1837. 8vo.—Schuh, Ueber den Einfluss der Percussion und Auscultation auf Chirurg. Praxis; in Oester. Jahrbüchern, vol. xxxvi. p 372.—von Rotteck, J., Ueber einige Brustkrankheiten, mit besonderer Rücksicht auf ihre Diagnose aus physikalischen Zeichen. Freiburg, 1839.

1894. The collection of these fluids may arise in various ways; by an abscess in the lung opening into the chest, in consequence of an inflammation of the lung and *pleura*, after penetrating wounds, extensive fracture of the ribs, and the like, from a perverse secretion, from an insidious inflammation of the *pleura* from organic disease of the lungs, as well also from the slow occurrence of *hydrothorax*.

Abscesses on the exterior of the chest between the pectoral muscles and the *pleura* rarely penetrate the cavity of the chest, because the *pleura* in general becomes much thickened.

[Sometimes the empyematous matter is discharged either by bursting into the lung itself, or through the walls of the chest. Under these circumstances, the effusion is circumscribed by adhesions, forming a distinct abscess, and separate from the general cavity of the *pleura*. According to LAENNEC, the matter of *empyema* is discharged more frequently by bursting into the *bronchi* than by ulceration through the walls of the chest. TOWNSEND (*a*), however, thinks that their frequency is nearly equal. Sometimes the abscess bursts both outwardly and inwardly, and thus a fistulous passage is formed for the escape of the pus. Instances of this kind are mentioned by LE DRAN (*b*) and by ANDRAL (*c*).]

1895. When from these collections in the cavities of the chest, the functions of the lungs and heart are destroyed to such extent as to endanger life, when the accumulation cannot be got rid of either by the powers of nature, or by suitable internal treatment, *opening the cavity of the chest* (*Paracentesis thoracis*, *Operatio empyematis*) is required. This operation can, however, only have a favourable result when the purulent or watery accumulation is unaccompanied with other incurable disease of the chest, or with symptoms of general dropsy and the patient have not been already greatly enfeebled by long continuance of the disease, or by colliquative symptoms, and is not very much advanced in age. The accumulation of pus in consequence of external injuries is the most hopeful for a favourable result to the operation, which, however, must always be considered a very serious one as regards the consequences that may arise from it; although, on the other hand, it must be remembered, that the efficiency of the operation is considerably undervalued on account of its too late and rare performance. In the above-mentioned cases, it is the only means of preserving life.

Opinions vary as to the period at which accumulations after inflammation take place in the cavities of the chest, as some are in favour of the early performance of the operation (PHILIP, SKODES, LAENNEC, GENDRIN, and others); it can, however, only be considered permissible under the above-mentioned conditions. (KRAUSE.) It has been already mentioned (*par.* 495) that and under what conditions, opening the cavity of the chest is necessary in extravasation of blood and collection of air.

1896. Opening the cavity of the chest is performed either by a cut or by a puncture with the trocar.

Opening the chest has been practised from the earliest times in very different ways; *first*, by boring through the ribs (HIPPOCRATES, PARÉ, SEVERINUS,) or through the breastbone (GALEN, ROGER, of Parma, PURMANN, VAN DER WYL, and others); *second* by division of the soft parts, α. with the actual cautery (EUNIPHON of Cnidos, PAUL of Ægina, AVICENNA, LANFRANCHI, RAVATON, and others,) β. with caustic, and thrusting a knife through the slough (THEVENIN, RUYSCH, BROMFIELD, VON WINTER, and others); γ. by puncture with the knife, after making a cut through the skin and laying bare the *pleura*, (HIPPOCRATES, CELSUS, SOLINGEN, DELPECH, and others,) or with the trocar, (HEISTER, MORAND, BOYER, and others,) with blunt instruments, as a sound (DIONIS, VERDUC, BELLOSTE,) or with the finger (FRECK); δ. without previously cutting through the skin, by thrusting in a knife, (RHAZES, DIEMERBROECK, PURMANN,) or the trocar

(*a*) Above cited in Cyc. Prac. Med.

(*b*) Observations de Chirurgie, vol. i. p. 255.

(*c*) Clinique Médicale, vol. ii. p. 489.

(Drouin, Nuck, Palfyn, Heister, Sharp, Leblanc, Rullier, Charles Bell, Laennec, Wattmann, Schuh, Krause, and others); ε. by dividing the skin and muscles by layers with a funnel-shaped cut and the division of the *pleura* to a great extent (especially Benjamin Bell, Larrey, Zang, Kern, and others.)

1897. *Opening the chest with a cut* is performed in the following way. The patient should be laid near the edge of the bed, bending over towards the sound side, and his arm brought forwards, so that the light may fall upon the part for operation. A cut of a full inch is to be made through the skin, in the middle between the breast-bone and the spine, on the right side between the fifth and sixth or sixth and seventh ribs, reckoning from above, but never lower, as otherwise the *diaphragm* may be easily wounded; upon the left side, between the fifth and sixth, to the seventh and eighth ribs. The muscles are then divided cautiously down to the *pleura*, by repeated cuts lengthways, and properly away from the lower edge of the upper rib, without completely exposing the upper edge of the lower rib, so that the cut is conical, and exposes about an inch of the *pleura*. If the finger be then introduced into the bottom of the wound, when the patient holds his breath or inclines a little to the diseased side, and distinct fluctuation be felt, the *pleura* may be carefully penetrated with the bistoury, and the opening enlarged with the button-ended bistoury. If no fluctuation be perceptible, the *pleura*, which is frequently thickened, must be divided by cutting cautiously. For the discharge of the fluid the patient must be inclined towards the diseased side. Deep inspiration, coughing, and the use of pumps or injections, to assist the discharge, are dangerous.

The place for opening the chest, when there is no protrusion of the *pleura* and accumulation beneath the external coverings, (*locus necessitatis*,) has been very variously recommended. Many (Sabatier, Pelletan, Boyer, and others) advise it on the left side between the third and fourth rib, counting from below, and on the right between the fourth and fifth ribs. Others (Chopart, Desault) on the left side, between the second and third, and on the right, between the third and fourth ribs. According to Bell, the lowest and most fitting place for the puncture is the interspace between the sixth and seventh rib, reckoning from above. According to Begin, the cut should be made at the junction of the two front with the hinder third of the space between the breast-bone and the spinous processes. Cruvelhier holds that the fluid should not on any account be completely emptied, and therefore the opening may be made where you please.

If in a very fat person the ribs cannot be counted, the place for the cut may be determined at from four to five fingers' breadth above the last false rib. Opening the chest at its most depending part, at a little distance from the spine is objectionable; because, by the patient's posture, a higher part may be brought lower down, because on the right side the *diaphragm* thrust up by the liver may be easily wounded, and adhesions at the lower part of the lung are extremely common. For these reasons, the interspace between the fifth and sixth ribs, upon either side, is to be preferred as the best place for *paracentesis*, if on percussion it yield a dull sound, and there be no perceptible respiratory murmur (*a*). Drawing up the skin before making the cut, so that it may drop down on the inner wound, may prevent the entrance of the air, but it also interferes with the free escape of the pus. If a part be cut on, where the lung is adherent, it must be attempted, if the adhesion be not firm, to separate it with the finger, or to divide it dexterously with a blunt-ended probe; but if this be not possible, the wound must be enlarged towards the breast-bone, in hopes of finding a part not adherent, or the operation must be performed at some other part. If after opening the chest no accumulation be found in it, but that there is an abscess in the lung itself, which is shown by the finger feeling fluctuation, a pointed bistoury must be introduced on the finger, and the abscess opened (1).

If there be need to open the cavity of the chest on both sides, the operation must be performed on the other side, if not pressingly required at once, from fourteen to eighteen days after, and the opening in the *pleura* made as small as the object of the operation will permit (2).

(*a*) Laennec, above cited, vol. ii. p. 219.

Cartwright (*a*) proposes, in order to prevent the admission of air in opening the cavity of the chest, to introduce a double thread, shaped like the Greek Ω after having made a small cut, and to apply sticking plaster over it.

[(1) I cannot think the recommendation here given of thrusting a bistoury into a presumed abscess of the lung, admissible under any circumstances. I have great doubt whether fluctuation could be certainly ascertained, and even if it were, I do not think opening it would be more justifiable, as it would be impossible to be sure of the thickness of the wall of the abscess; whilst, in either case, the patient would be endangered by the bleeding which would follow wounding the lung; on which account, therefore, I think it would be highly imprudent to risk so serious a consequence.

(2) I should also be exceedingly loath to open the chest on the opposite side, as here recommended by Chelius.—J. F. S.]

1898. The dressing consists in the introduction of an oiled fold of half unravelled linen, between the edges of the wounded *pleura*, without dropping it into the cavity of the chest, its ends being fastened with sticking plaster, and over it laid a plaster full of holes, soft lint and a compress properly confined with a bandage over the chest and one shoulder. The patient should be laid so as to favour the discharge of the pus as much as possible.

If the accumnlation be large, the dressing should be applied without discharging all of it. Pelletan (*b*) advises, in every case, the application of the above-described dressing, so that the cavity of the *pleura* is opened, and the fluid can gradually escape, and the air should not enter so that the lungs might expand.

1899. The *after-treatment* requires, according to the condition of the patient, and the symptoms which may arise, a cooling, antiphlogistic, or a restorative treatment. The patient must be kept quiet, and not talk; and the surrounding air should be properly dry and warm. The dressing should be renewed as rarely as possible, at the utmost never more frequently than every twelve or fourteen hours. Injections employed for the purpose of encouraging the discharge are indeed usually objectionable. I have, however, in cases where subsequently the discharge was very bad and stinking, used injections of mucilaginous decoctions, with a slight addition of muriatic acid, and slightly astringent decoctions with advantage. The wound must be kept open by this dressing as long as there is any secretion. Tubes of elastic gum and the like, for this purpose, are objectionable; repeated experience, however, has shown that the mere introduction of the fold of half unravelled linen is insufficient to keep the wound properly open. A fistulous aperture often continues for a long while, which only closes when the patient's health is fully restored.

To prevent the hectic fever which, after the operation for *empyema*, results from the absorption of pus and its putrescence by the admission of air, Recamier (*c*) injects warm water, 28–30° Réaumur, (95–99½° Fahr.,) immediately after the discharge of the fluid from the chest, and in corresponding quantity to the discharge. The aperture should then be closed with sticking plaster, and the patient laid with his *pelvis* high, so that the water may completely fill the cavity of the chest. In proportion as the lungs expand, which is ascertained by auscultation, less water should be injected.

1900. In *puncturing the chest with the trocar*, between the fifth and sixth ribs, if that part yield a dull sound on percussion, and no respiratory murmur be perceived, the point of the left forefinger is to be placed upon the upper edge of the lower rib, and the trocar, held in the right hand, thrust above the finger-nail through the intercostal space, with sufficient but not too sudden pressure, till the opposition offered cease, and shows it has entered the cavity of the chest. The canula is then taken hold of with the fingers of the left hand, and thrust deeper into the chest, whilst

(*a*) London Medical Gazette, vol. viii. p. 105. 1831.

(*b*) Above cited, p. 295.

(*c*) Bullet de Thérap., vol. xii. 1837.

with the right hand the trocar itself is withdrawn, immediately upon which the fluid streams out. From time to time the opening of the canula should be closed with the finger, so that the patient may inspire rather more deeply, and it may be seen when the discharge is completed; the canula should then be removed, and the finger placed upon the opening, which is to be covered up with sticking plaster. Whilst the discharge is going on, to prevent the entrance of the air into the chest, and to assist the escape of the matter, various modes of proceeding and practice have been recommended, as well also as different reasons proposed for the quantity of matter to be drawn off.

For the purpose of preventing the entrance of the air, valvular canulas and stop-cocks, with syringes and cupping instruments attached to them, have been employed. **Bouvier**'s canula with a ball valve; **Reybard**'s canula with a bladder; **Recamier**'s trocar, the front aperture of which, by drawing back a stilette, is covered with a spring pad; **Schuh**'s trocar, its canula furnished with a stop-cock, and a trough screwed on it, in which the fluid as it escapes from the canula is collected, and may be raised higher than the opening of the canula, being guarded with a leather valve. **Krause** (*a*) objects to **Schuh**'s trocar that its canula is too narrow to allow the escape of pus or thicker fluid, that the play of the leather valve is frequently out of order, so that the fluid sticks to its edge; if the narrow canula be stopped up, the apparatus must be unscrewed, and a probe introduced. The following method has been recommended by **Baum**: the operator holds above the plate of the canula, fixed by an assistant, a piece of goldbeater's skin so stretched with both hands that there remains only a small aperture, through which the fluid escapes directly. He must very carefully watch the discharge, so as to immediately close the opening air-tight by dropping down the goldbeater's skin as soon as the stream begins to stop. **Guérin**, **Stansky**, and **von Wattmann** fasten a sucking pump to the canula. Compare on the contrary **von Winter** (*b*). **Laennec** has proposed, in weakly patients, in whom the complete discharge of the fluid may cause dangerous fainting, and in cases where no cure can be hoped for, and the operation is undertaken only for relief, that merely a part of the fluid should be discharged. According to **Schuh**, in those cases where the effusion is ten or twelve days' old, the lungs and constitution healthy, and a radical cure may be expected, as much as possible should be at once discharged, and that then it should be allowed to flow by the trough without much talking and effort. If, on the contrary, the pleurisy and its products be already a month old, and the patient cachectic; if there be hæmorrhagic exudation, accompanied with tubercles on the lungs, and no cure be expected, a small discharge will be sufficient, even when the fluid readily empties itself with perfect freedom. Inattention to this circumstance produces a *peritonitis*, quick reproduction of the exudation, and *pneumonia*. **Krause** (*c*), on the other hand, remarks, that we may be deceived in regard to the existence of tubercles, as **Skoda** himself experienced in several instances; and that, therefore, even in the most doubtful cases, the patient's complete recovery should never be given up, and that it is often not possible to retain the remaining fluid by the ordinary dressings.

1901. The symptoms which occur after puncturing the chest with the trocar, are, besides fainting, for which analeptics should be given, a violent cough, which depends on the entrance of the air and of blood into the lungs, for which opiates must be given, *pleuritis*, especially if the puncture be made whilst there is still inflammatory excitement, *pneumonia*, inflammation of the *diaphragm*, and speedy reaccumulation of the fluid. A corresponding antiphlogistic treatment must be employed for the inflammatory symptoms and absorption of the recurring exudation, by those remedies which strengthen the powers and excite the secretions, such as diuretics. **Krause** especially recommends milk at regular periods, and in gradually increasing quantity, and iodide of iron. If the symptoms of accumulating fluid be urgent, the puncture must be repeated.

1902. The preference of opening the chest by cutting, or by the trocar,

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(*a*) Above cited, p. 167.

(*b*) Jahrbücher des ärztlichen Vereines zu München, Jahrg. iv. p. 10.

(*c*) Above cited, p. 174.

must be decided by the following circumstances. In primary extravasation of blood, and in accumulations of pus, the opening of the chest by cutting into it should be considered preferable ; as in extravasation of blood its discharge by the trocar cannot indeed be effected, and in the suppurative accumulation, a continued discharge must be kept up, under which circumstance the union of the pleural surfaces is not produced by adhesion but only by firm exudation and granulations. On the other hand, puncture with the trocar is more proper in acute *empyema* and watery accumulation, in very weak patients, and when the operation is undertaken rather with a view to the relief of the patient.

In accumulations of pus SCHUH has proposed, after removing the trocar-canula, to introduce a gum elastic tube, and fasten it securely ; KRAUSE, however, objects to this as producing greater pain. If, together with the puncture, a cut be not made, the wound, according to KRAUSE, should be covered with a poultice ; it closes, in course of a few days, but, with the continued use of the poultice, sometimes opens again, and discharges pus constantly. If this be not done, a cut should be forthwith resorted to.

1903. The mode and condition by which, after the discharge of bloody, serous, or purulent extravasation from the cavity of the chest, the cure is effected, and the satisfactory or unsatisfactory result of the operation ensues, is shown by the following circumstances confirmed by pathological anatomy,

In every large accumulation of fluid in the cavity of the chest the lung is compressed, the pulmonary vessels no longer permit the fluid to be properly poured forth, which, under natural circumstances, fill it, they are gradually obliterated, the proper structure of the lungs wastes, and it hangs quite shrivelled up, as on a stalk. If under these circumstances fluid be discharged from the cavity of the chest, the lung is never again expanded and developed, the space which had contained the fluid remains empty, and nature must effect the cure in some other way than by the development of the lung. Hence it must be concluded that the result of the operation is the more uncertain, the longer the accumulation of fluid in the cavity of the chest has existed. If, after the discharge of the fluid, air enter the cavity of the *pleura*, which cannot by any precaution be prevented, the walls of the cavity may inflame, and if the inflammation become violent, it may cause death. If the patient get over this period, a profuse suppuration takes place over the whole surface of the *pleura*, which runs through its stages with greater or less quickness, according to the constitution and age of the patient. A cure can only happen when, by this development of granulations, by the successive expansion of the lung, and by the dropping together of the chest, by which the curve of the ribs is diminished and their form rendered more cylindrical, the *pleura* unites with the surface of the lung. On these grounds is explained why, in great and long continued accumulations, &c., in the cavity of the chest, and in old persons no cure in general takes place, though in younger persons, in whom the walls of the chest are yet yielding, and if the accumulation have not existed long, the cure very commonly, and often very quickly follows. The same changes affect the chest in the cure after puncturing with the trocar as those which occur where absorption of the *empyema* has taken place without the operation. KRAUSE points out a change of the chest in which the shoulder is drawn upwards and the spine is inclined towards the diseased side, which may depend on the high position of the fistula in the chest (*a*).

(*a*) See PELLETAN and LARREY, above cited.

Laennec (*a*) proposes, for the purpose of encouraging the expansion of the lung, to apply a cupping glass and syringe upon the wound.

The return of resonance over the whole surface of the chest and of the respiratory murmur proves the subsidence of the effusion, but the continuance of the dull sound does not prove its continuance; for very frequently pseudo-membranes form after pleuritic effusion, which overspread the lung to various extent, and in some instances completely envelope it. As these pseudo-membranes produce a dull sound the continuance of the effusion may be presumed, although it have already ceased. When these pseudo-membranes have long existed, and the patient is attacked with *bronchitis* or rheumatic pain on the ailing side, it may be mistaken for an attack of pleurisy. But with pseudo-membranes the dull sound does not change its place according to the posture of the patient, and its height is not so well defined as in effusion. It rises to the same height on the fore and hind part of the chest, and this distinction is often so great that the whole hind part of the chest gives the dull sound, whilst the fore part is perfectly sonorous. The dull sound may also exist at the upper or middle part of the chest, whilst the lower remains sonorous. A partial, circumscribed outpouring may, in that case, present the same peculiarity; but then, according to Louis, a partial elevation of the chest has been noticed, as on the contrary, when the dull sound is caused by pseudo-membrane consequent on effusion which has compressed the lung, not unfrequently a slight sinking in of the diseased side is perceived by mensuration. When the rasping sound is also heard the presence of pseudo-membrane is beyond doubt (*b*).

[The operation for *empyema* has been of late years not unfrequently performed in London, and an account has been given by the late and much regretted Dr. Thomas Davies (*c*) of the result of twenty-three cases, all of which, excepting six, were under his own care. Of these, eleven were operated on for *empyema*, eight recovered, two died, and one was under treatment; nine for *pneumothorax*, all of whom died; and three for *hydrothorax*, who also died. Davies observes, upon these cases:—" *First* The result of the operation in the cases of *empyema* is very satisfactory, eight of the patients out of ten have recovered. Of these, five were under six years of age, one was between eighteen and nineteen, and two were above twenty-five. *Second.* All the cases of *pneumothorax* were complicated with tubercular diseases of the lungs, a circumstance which, of itself, precluded a favourable result. All the patients were beyond twenty years of age. *Third.* All the cases of *hydrothorax* were the consequences of disease of the heart. Although none of the patients recovered, they were all relieved by the operation for a considerable time." (p. 43.)]

VI.—OF DROPSY OF THE PERICARDIUM.

(*Hydrops Pericardii*, Lat.; *Wassersucht des Herzbeutels*, Germ.; *Hydropéricarde*, Fr.)

1904. Dropsy of the pericardium generally accompanies water in the chest, and but rarely exists alone. The following symptoms accompany it; the sensation of weight and pressure in the region of the heart, and a feeling as if the heart were swimming in water, great shortness of breathing, and anxiety, which increases on the slightest movements of the body, but especially in the horizontal posture, frequently going on to faintness and danger of suffocation; the beat of the heart is felt to a great extent, and at different parts; also accompanied with violent palpitation, or more frequently a fluttering tumultuous movement of the heart, as if there were something lying within it. The dashing of water is often distinctly felt, or even seen between the third and fifth ribs. The pulse is small, quick, hardish, often irregular and intermittent; cough occurs only spasmodically, and is dry; the speech is difficult, and the voice hoarse. When the disease has existed long, the countenance is puffy, the extremities usually cold, and the patient feels a peculiar pain in the stomach and over the whole belly. Death follows either from suffocation or from apoplexy.

(*a*) Above cited, vol. ii. p. 220. (*b*) Hirtz, Pigné.

(*c*) Cyclopædia of Practical Medicine, above cited.

According to Laënnec, slight effusions, as, under a pound, cause no decided symptoms; but those exceeding two or three pounds, are shown by percussion, auscultation, and inspection.

In some cases of considerable pericardial dropsy, the breast-bone exhibits a remarkable elevation. Piorry believes that a careful measurement would show greater distension of the left side from above downwards, or from the one side to the other. In one case (*a*) the liver was so thrust down, that its lower edge projected two inches below the edge of the false ribs. If but little fluid be collected, it makes little pressure towards the sides of the *pericardium;* therefore percussion discovers a dull sound, rather from above downwards, than from side to side. This dull sound varies according to the different posture of the patient, on his back, whilst sitting, or in lying on his side; the change of place of the dull sound in the side posture is of less value than when on the back, or sitting, because it depends on displacement of the heart. In large collections of water, the stroke of the heart is, according to Bouillaud, deeper, less to be felt, and the accompanying murmur more obscure, less perceptible at a distance than in the natural state; and if to these symptoms be added a duller sound, the existence of dropsy of the *pericardium* is exceedingly probable, even if it be not quite certain.

According to Piorry, in large collections of water a perfectly dull sound is found in a pyramidal space; the base of which is the region of the heart, and the point at the upper part of the breast-bone.

Gendrin thinks that there is stabbing pain on the left side of the chest towards the shoulder, arm, and back, opposite the base of the heart; or it may be confined to the region of the stomach on the outer edge of the ensiform cartilage, and is rarely wanting; the point of the heart is displaced inwards and upwards to the top of the third rib, and on account of the oblique position of the large vessels thus caused, at the place of their opening, a rubbing noise is observed at the base of the heart, in the arch of the *aorta*, and in the *arteria innominata*, which noise diminishes in proportion as the fluid is absorbed.

Hypertrophy and expansion of the heart may be distinguished by their slow origin, by the various condition of the beating of the heart, and by the dull sound, by the various condition of the *pericardium*, and the dull sound in a round space. (Pigné.)

1905. The quantity of water in the *pericardium* is various, and sometimes amounts to many pounds; it is usually like *albumen*, yellowish, whitish, reddish, and, when arising merely from a perverse secretion, is unaccompanied with any diseased change of the heart, or of the *pericardium* (*b*). Frequently is the *pericardium* united to the neighbouring parts, and thickened; the surface of the heart is inflamed, excoriated, sometimes covered with layers of purulent matter; sometimes the water is found in sacs attached to the heart or to the *pericardium*. At the same time, other organic diseases of the heart, of the large vessels, and lungs are found, which in many cases are the cause, and in other the consequence, of the pericardial dropsy, and therefore the fluid is of a different nature. Chronic inflammation of the heart or its sac, wounds and the like may give rise to it: and predisposition thereto frequently originates in pregnancy and childbed.

[In very rare cases, inflammation of the *pericardium* runs on to suppuration: there is an example of this kind which has been in the Museum at St. Thomas's many years. The swelling protruded at the pit of the stomach, and, being supposed an abscess of the liver, was punctured, and the pus discharged. After death, the disease was found in the *pericardium*. I do not know any further particulars of the case.—J. F. S.]

1906. When, in dropsy of the *pericardium*, the *diagnosis* be decided, and it be also ascertained that there is not any accompanying organic disease of the heart, if the usual remedies be unavailing, the emptying of the water, or even of the blood in wounds (*par.* 505), has been proposed, an operation which, in reference to its practice and consequence, must be considered extremely dangerous.

(*a*) Bouillaud; in Dict. de Med. et de Chirurg. Prat., vol. x. p. 158.

(*b*) Laennec; above cited, vol. ii. p. 669.

This operation, first proposed by **Senac**, is rarely practised, and of all the cases performed there are but two which had a favourable result. **Karawajew** (*a*) has performed it twice on account of exudation of blood into the *pericardium*, arising from scurvy; one was fatal and the other successful, and in the latter case three and a half pounds of bloody fluid were discharged. **Schuh** (*b*) has also operated successfully.

1907. The seat and manner of making the opening have been variously given. A cut made on the left side, two fingers, and in a large extravasation, at from four to five fingers' breadth from the breast-bone, between the fourth and fifth, or fifth and sixth true rib, or at any other place, if the heart have haply changed its position, and there be distinct corresponding fluctuation, carefully through the skin and muscles, down to the *pleura*, which must be opened with the greatest carefulness, and the opening enlarged with the button-ended bistoury. The exposed *pericardium* is cautiously opened with the bistoury, and the fluid allowed to escape gradually. **Senac** fixes the place for the opening between the third and eighth rib, and five or six inches from the breast-bone; **Camper** between the fourth and fifth; **Romeiro** and **Larrey** between the fifth and sixth; and **Desault** between the sixth and seventh rib. More recently, **Larrey** has proposed that in the space between the base of the sword-like cartilage and the united cartilages of the seventh and eighth ribs, an oblique cut should be made along the lower edge of the cartilage of the seventh rib, to the extremity of the eighth, by which some fibres of the *m. rectus* and *obliquus externus abdominis* are cut through, and then should penetrate deeper through the cellular tissue, till that part of the *pericardium* is reached which projects between the first two digitations of the *diaphragm*, and into which the knife is to be carefully thrust from above and to the left side. **Hager**'s proposal must also be mentioned, to draw out the exposed *pericardium* with a thread, into the wound of the *pleura*, after the discharge to bind up the opening, and to fasten the thread externally, so that the *pericardium* may unite with the wound. **Skielderup** (*c*) advises perforating the breast-bone between the fifth and sixth ribs, where the cartilage of the fifth rib joins the breast-bone, with a common trephine; and when, after the bleeding is stanched, the fluctuating *pericardium* protrudes into the aperture, to open it. This practice has the advantage of the *pericardium* being laid bare at the part where it is directly in contact with the breast-bone, the *pleura* not at once opened, and the water not poured into the cavity of the chest. **Karawajew** penetrates with a trocar, as advised by **Senac**, but warned against it by **Desault**, between the fifth and sixth rib, three fingers' breadth from the breast-bone, into the *pericardium;* **Schuh** also uses the trocar in the fourth intercostal space on the inner side of the internal mammary artery. The dressing and after-treatment are the same as after opening the chest (*d*).

Richerand (*e*) proposes to lay bare the front of the *pericardium* by removing a portion of the cartilage, and of the rib, and so to open it that not only the fluid escapes, but such degree of adhesive inflammation is set up, that union of the secreting surfaces, and a radical cure ensues.

(*a*) Preuss. Vereinzeit. 1840. No. 52.

(*b*) Above cited.

(*c*) De Trepanatione Sterni et Apertura Pericardii; in Acta Nord. Soc. Med. Harniensis, vol. i. p. 130. Haun., 1818.

(*d*) **Senac**, De la Structure du Cœur, p. 365. Paris, 1749.—**van Swieten**, Comment. in Aphorismos Boerhaavii, vol. iv. p. 138.—**Desault**, Œuvres Chirurg., vol. ii., p. 304.—**Larrey**, Mémoires de Chirurgie Militaire, vol. iii. p. 459. Paris, 1812. 8vo.

(*e*) Histoire d'une Resection des Côtes et de la Plèvre, p. 10. Paris, 1818.—**Nicod**, Dissert. sur le Danger de la Resection des Côtes, &c. Paris, 1818.

VII.—OF THE ACCUMULATION OF SEROUS AND PURULENT FLUID IN THE MEDIASTINA.

1908. A collection of water in the anterior *mediastinum (Hydrops Mediastini)* occurs only in connexion with dropsy of other kinds. More frequently a collection of pus or blood takes place in the *mediastinum*, in consequence of an external wound which has penetrated the breast-bone, or has injured its surface only after *inflammation of the mediastinum*, *(Pleuritis Sternalis,)* or it follows carious destruction of the breast-bone.

1909. The signs of such accumulation are more or less uncertain. If there be symptoms of inflammation of the *mediastinum*, fever, difficult breathing, pain behind the breast-bone, which generally extends downwards towards the pit of the stomach, upwards towards the air-tube, and backwards towards the spine; if these symptoms be consequent on external injury, the pain subsides with frequent shiverings; if the patient feel a sensation of weight and pressure behind the breast-bone, if there be oppression and hectic fever, no doubt can remain of the presence of pus behind the breast-bone. If there be carious destruction accompanied with a fistulous opening, the introduction of a probe and the more free escape of pus in particular positions of the patient, besides the above-described symptoms, point out the nature of the disease.

If, soon after the breast-bone has been injured by external violence, difficult breathing, pressure and weight behind the breast-bone, and general symptoms of hidden hæmorrhage occur, an extravasation of blood has taken place into the *mediastinum*.

1910. When the existence of extravasation into the *mediastinum* is ascertained, its removal is necessary, must not be long delayed, and is effected by *perforating the breast-bone (Perforatio, Trepannatio.)* This operation may be also necessary, in addition to the above-mentioned diseases, for the purpose of removing a dead piece of the breast-bone, or in order to make the reduction of a fracture possible (*par.* 624.) The part at which the perforation is to be made is directed according to the different objects of the operation: thus, in extravasation, the aperture is to be made opposite it, and where possible at the lowest part; if the ends of a fracture be driven in, upon the still firm remaining part of the bone near the edge that is depressed; and in *caries* must be so made upon it, that all the diseased part may be removed.

1911. A cut is to be made about an inch and a half in length along the middle line of the breast-bone through the skin, its middle corresponding with the part to be perforated. The edges of this wound are then drawn asunder by assistants, the *periosteum* cut through to the extent of the trepan-crown, and then removed with a scraper. The perforation is best made with a trephine, according to the rules laid down in trepanning (*par.* 441.) The perforated bone must be lifted out with an elevator, and any connexions with the internal *periosteum* divided with the knife.

But in children, whose breast-bone is still cartilaginous, the perforation can be made with a trocar without a canula.

1912. After the collected fluid has been discharged by proper posture and sopping up with a sponge, a simple dressing must be applied, and a piece of linen spread with mild ointment introduced into the wound fastened with sticking plaster, and bound on with a scapular and chest bandage. The *after-treatment* depends on the ensuing symptoms of inflammation and suppuration, and is much the same as that directed after the operation of *empyema*.

Upon Trepanning the Breast-bone, see

De la Martinière, Mémoire sur l'Opération du Trepan au sternum; in Mém. de l'Acad. de Chirurg., vol. iv. p. 515.

Clossius, De perforatione Ossis Pectoris. Tubing., 1795.

Fabrice, Diss. de Empyemate Mediastini ejusque curatione, ope Trepani. Altorf., 1796.

VIII.—OF DROPSY IN THE BELLY.

(*Hydrops Abdominis, Ascites*, Lat.; *Bauchwassersucht*, Germ.; *Hydropisie, Ascite*, Fr.)

Martini, F., Ueber die Art der Abzapfung des Wassers bei der Bauchwassersucht; in his chirurgischen Streitschriften, vol. ii. p. 25.

Monro, Donald, M.D., An Essay on the Dropsy and its different species. London, 1765. 8vo. Third Edition.

Ackermann, De Paracentesi Abdominis. Jenæ, 1787.

Spiritus, Dissert. variæ rationes Paracentesis Abdominis instituendæ. Jenæ, 1794.

Ehrlich's Beobachtungen von der Bauchwassersucht; in his chirurgischen Beobachtungen, vol. i. chap. x.

1913. In *dropsy of the belly*, the water collects either in the whole cavity of the *peritonæum*, (*General Dropsy*,) or in a proper sac, (*Encysted Dropsy*,) which may be attached either to the *peritonæum*, or to one of its folds, or it may be formed on some one particular bowel, most commonly to the ovary (*Ovarian Dropsy*.) In both cases, if the accumulation of water be so great as to produce distension and fluctuation of the belly, and do not yield to the usual remedies, then its removal by *tapping* (*Paracentesis Abdominis*, Lat.; *Bauchstich*, Germ.) is required.

1914. This *treatment*, indeed, is usually only palliative, as the water soon re-collects; but it may so far assist the cure as that, after its removal, the remedies which had previously been useless, act efficiently, or if the causes of the dropsy be got rid of. This will happen so much sooner if the operation be undertaken early, and great re-collection of the water be not permitted before it be again drawn off. Although considered merely as a palliative, yet the operation has the advantage over long-continued internal remedies for the purpose of discharging the fluid by the urinary organs, or by the alimentary canal.

In encysted dropsy, the operation rarely assists the radical cure, but is more likely to do so if not too long delayed, if there be yet no organic changes in the sac, thickening, scirrhous hardening, and the like. When with dropsy of the belly there is considerable and painful hardening of the bowels, in encysted dropsy, if the collection be very considerable and of long standing, if the patient's powers have been much sunk thereby, the operation may produce relief for a time, but soon afterwards the patient becomes worse, and usually the fatal termination is hastened. If in encysted dropsy, the position of the sac be such that the operation is not possible without injuring some important part, it is positively forbidden.

1915. The spot where tapping is performed, is either the middle of a line, supposed to be stretched from the navel to the upper front iliac spine, especially on the left side, or the point where a line, drawn from the lower edge of the last false rib to the crest of the hip-bone, is crossed by another carried horizontally from the navel to the back. As, however, in *ascites*, the front wall of the belly is in general most considerably distended, and the straight muscles become much broader, there is not unfrequently danger in making the puncture at the spot mentioned, of wounding either a part of the belly where the muscles are thicker, or the epigastric artery, or one of its branches. On this account the puncture on the white line, two or three inches below the navel, where the walls of the belly are generally thinnest, and no injury of any one artery is to be feared, is preferable (*a*).

[According to ASTLEY COOPER (*b*) we, at least in England, are indebted to the elder CLINE for the adoption, if not the proposal, of tapping in the white line. "His reason for this change was, that in the spreading of the abdominal muscles from the pressure of the water, the epigastric artery is brought into a situation of risk of being wounded by the trocar. This happened to him in tapping a person in St. Thomas's Hospital: florid blood issued through the canula, and the quantity gradually increased as the water flowed: as the patient was becoming faint, he withdrew the canula, and closed the wound, but the bleeding continued into the *abdomen*, and the man died; upon inspection the epigastric artery was found wounded." (p. 381.)]

1916. When decided hardening of the bowels is felt, another, and indeed the most distinctly fluctuating part is to be chosen: in encysted dropsy that, where the fluctuation is the most strong, care, however, being always taken to avoid the epigastric artery; the navel, if its surface be distended like a bladder; the *scrotum*, if there be a rupture-sac without gut or *omentum;* the *vagina*, when, by the pressure of the water, it is protruded. In the latter two cases, care must, however, be taken that a piece of gut or *omentum* have not united with the rupture-sac, and that the protrusion of the *vagina* have not been caused by the bowels, especially by the urinary bladder (*c*).

1917. The patient is to be put into a half sitting posture, but, if very weak, he must be laid more horizontally on a bed, with the part where the operation is to be performed towards its edge (1). A broad belly bandage, having a four-cornered hole opposite the part to be punctured, is then applied and drawn rather tightly upon the back by assistants. The operator holds a trocar of proper thickness, and furnished with a silver canula in his right hand, so that the forefinger stretches along the latter, to about an inch and a half of the point of the trocar, which he pushes in with a rotatory motion and rather obliquely through the walls of the belly, the thumb of the left hand being placed below the point of puncture. A diminution of the obstruction shows that the trocar has entered sufficiently deep, and then the operator, with the finger of his left hand, fixes and holds fast the canula at the edge of the perforated skin, with the other hand draws out the trocar and allows the water to escape, the assistants generally tightening the belly-bandage in proportion, whilst another assistant, with both his hands spread upon the sides of the belly, moderately compresses it. If the quantity of water be large, the mouth of the canula should be frequently closed with the finger, or otherwise an overloading of the blood vessels of the belly and fainting will quickly occur. If the flow of water should be checked by the clogging of the canula, or if anything lie against its inner end, either a probe must be introduced or a thinner canula, closed at its end but with openings on its side, or the direction of the canula already introduced must be changed, or it must be withdrawn a little. If the operation be performed on an

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(*a*) COOPER SAMUEL, Dictionary of Practical Surgery, p. 1081.

(*b*) Lectures on Surgery, by TYRRELL, vol. ii.

(*c*) ZANG, Operationen, vol. iii. p. 295.

incurable patient, merely for the purpose of relief, and the accumulation of water be very great, only a third, or, at furthest, not more than half, should be allowed to escape. When the fluid is so thick that it cannot escape through the canula, it is recommended to introduce a longer trocar, or to enlarge the wound with a knife, or with a piece of tent introduced into the wound (2).

A round and tolerably thick trocar is undoubtedly the best instrument for tapping (*a*).

[(1) Before the operation of tapping is performed it is always advisable to pass a catheter so as to ensure the emptiness and safety of the bladder; and this may also be useful in correcting any mistake in the *diagnosis* as to the cause of the swelling, since great distension of the bladder, from retention of urine, may so completely simulate dropsy as to deceive the most wary; at least, since John Hunter was deceived, and tapped a distended bladder for dropsy, if Everard Home tell truly, it well behoves others to be cautious.

In women, also, it is especially necessary that no mistake should occur with regard to the condition of the womb. I knew of an instance in which a pregnant woman would most certainly have had a trocar thrust into the womb by a very eminent Surgeon had he not been providentially prevented by the better knowledge of an able practitioner in midwifery. Such dreadful errors have, however, been perpetrated.

(2) I do not think a trocar of any kind is the best instrument for tapping. If it were certain that the walls of the belly were always thin, and not tough, it might, perhaps, be so, though I doubt it. But the wall of the belly is very often, nay, very frequently thick, from effusion into the cellular tissue between the skin and muscles, and often tough also, and therefore the trocar requires to be thrust in with more force than is advisable or safe; and it is only surprising that, in the careless way in which tapping is too frequently performed, so little mischief results from it, as too frequently the danger of wounding an intestine by driving a trocar with a plunge into the belly up to the hilt, does not seem to enter the mind of the operator. I much prefer the Clines' practice of puncturing the wall of the belly with an abscess-lancet, and then introducing a blunt-ended canula through the wound, notwithstanding Samuel Cooper's assertion that " it is superfluous." Immediately the lancet, which should be introduced with its edges vertical, has entered the cavity, the fluid begins to escape, and a blunt canula can be passed without difficulty through the wound. In this way there is no opportunity, or at least as little probability as possible, of injuring an intestine; and the wound, instead of being a bruised one, as it is from the trocar, is a simple clean cut, most favourable for union.

I do not recollect to have seen any instance in which it was necessary to stop the escape of the water from the belly on account of the overloading of the vessels or fainting. It is very true that in tapping a dropsy faintness does often occur, but this depends on the want of support which the diaphragm suffers from the withdrawal of the fluid, which had previously thrust it up into the chest and diminished the capacity of the lungs; but when, by the escape of the water from the belly, and consequent relief of the diaphragm from pressure, the lungs and heart have increased room, are capable of receiving, and do receive more blood at the expense of the brain, then faintness ensues. To prevent the diaphragm losing its acquired support, and to preclude its sudden descent and the consequent fainting, the common practice of a sheet folded, passed round the belly, crossed on the back, and the two ends continually but gently pulled by assistants, so as to keep the sheet tight and support the remaining contents of the belly against the diaphragm, and not merely to hasten the flow of the water, as generally supposed, should be always employed.

If, whilst the water flow off the patient become faint, which is not at all unfrequent, the tightness of the draw-sheet should be carefully attended to, and wine or brandy given in such quantity as may seem fitting.—J. F. S.]

1918. When the water is emptied, the operator grasps the canula with the fingers of his right hand, closing its mouth at the same time with one finger, whilst with the fingers of the other hand the wall of the belly is held back, and the canula slowly withdrawn by turning it on its axis.

(*a*) Upon the different forms of trocar consult Gusovius, Dissert. qua novem Paracenteseos instrumentum offertur, Regiomont, 1722; in Haller's Collect. Dissert. Chirurg., vol. v. p. 611.— Arnemann, Uebersicht der berühmtesten und gebräuchlichsten Instrumente, p. 132. — Krombholz, Akiologie.

The wound is then cleaned, covered with a four-cornered piece of sticking plaster, a compress put upon it, and the belly-bandage having been moderately tightened, is made fast.

Bleeding may occur after tapping in three ways:—*first*, by wounding a bowel in pushing in the trocar, blood then escapes mingled with the water; *second*, by rent of the blood-vessels from overfilling, after the quick removal of the pressure; in this case, towards the end of the operation, the water is tinged with blood; and, *third*, by wounding the epigastric artery, or one of its branches, the blood then appears after the removal of the canula, or it may be poured into the belly and symptoms of hidden bleeding ensue.

In the first two cases proper compression of the belly with cold applications should be employed; in the third attempts should be made to stanch the bleeding, by the introduction of a stiff bougie or a piece of wax taper into the wound, or the wall of the belly should be raised into a fold and compressed for some hours (*a*).

The external branch of the external epigastric artery, generally the largest, is sometimes scarcely observable, whilst on the contrary the vessel itself, with its principal branches, passes upwards and inwards, where on tapping, a dangerous bleeding readily ensues if one or other of them be very large (*b*).

[I once, very soon after becoming Assistant Surgeon to St. Thomas's Hospital, had the misfortune to puncture the epigastric artery in tapping a dropsy of the belly. I had tapped this patient on the first occasion in the usual place, on the white line, midway between the *pubes* and navel. Some weeks after my friend Green tapped him again, and about a month after, a third tapping was performed by me. Fancying that perhaps the scar would not readily heal if I tapped in the same place again, I passed the lancet into the white line scarcely half an inch below the old scar, and afterwards the blunt canula. As the water flowed he became very faint, but not more so than I have frequently seen without any ill consequence; and indeed wounding the epigastric artery never crossed my mind, for I felt assured I was far away from it; nor was there any blood with the water, or from the wound afterwards, to lead to suspicion. Wine and brandy were given, and he was put to bed quickly. He gradually sunk, and died within twelve or fourteen hours. On *examination*, the belly was found full of blood, I should think four or five pints; and on carefully dissecting the wound and its neighbourhood, the epigastric artery was found to have inclined inwards, very soon after its origin from the iliac, and ran up behind the white line through a large part of its extent, between the *pubes* and navel, so that it was remarkable the vessel had escaped wound in the first two operations. From this untoward case I learnt a lesson I have never forgotten, and which I would anxiously impress, to wit, that if tapping be performed safely at one spot, it should be again and again performed in the same place, if the patient required tapping twenty times. I have known another example very similar to my case, which happened in the private practice of a medical friend, and with the same painful result.

I also had another case in which there was considerable difficulty in drawing off the water at all, as I had tapped with a trocar and open canula, and the intestines fell so upon the edge of the tube that I could only give escape to the fluid by introducing a long elastic gum catheter through the canula into the belly. In this case, the water was much tinged with blood, and, on the removal of the catheter and canula, there was a very free discharge of dark-coloured blood from the wound, which alarmed me much, and was stayed with difficulty by pressure on the sides of the wound. No ill consequences, however, ensued, and some time after I tapped her again without recurrence of this annoyance. Whether correctly or not, I presumed, from the dark colour of the blood, that I had wounded some large veins.—J. F. S.

Watson (*c*) mentions an "instance which he witnessed: clear serum issued for some time through the canula, but at length pure blood, not less than a pint. The patient sunk, and no opportunity was given to investigate the cause of the bleeding. In another strange but well-authenticated case, the almost incredible quantity, twenty-six pints, of blood, flowed out at the orifice made by the trocar, and afterwards separated into clot and serum. To the wonder of those who saw the incident, the patient recovered from the tapping; and the source of the hæmorrhage is still a matter of conjecture." (p. 399.)]

1919. For the first two days after the operation, the patient should be kept quiet, and allowed only a little light food. On the third day the

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(*a*) Medical Communications, vol. ii. p. 482.

(*b*) Edinburgh Med. and Surg. Journal, vol. viii. p. 281. 1822.

(*c*) Lectures on the Principles and Practice of Physic, vol. ii.

dressings may be replaced, and at the same time rubbing in volatile ointments, spirituous fluids, or diluted spirit of *ammonia*. If there be inflammation of the *diaphragm*, or of the bowels, the patient must be treated antiphlogistically, with due attention to the state of the constitution. The inflammation sometimes runs on very speedily to gangrene or to suppuration. Colicky pains, if not inflammatory, require aromatic waters, with the addition of some antispasmodic. If the water re-collect, the operation must be repeated, when fluctuation is again distinct.

1920. The following remarks must be made in reference to the different parts at which tapping must be, under peculiar circumstances, (*par.* 1916,) performed. In puncturing through the navel, the trocar must be thrust through its bladder-like distension and the enlarged navel-ring. Puncture through the *scrotum* must be performed in the same way as will be directed for hydrocele. In puncturing through the *vagina* (*a*), after having forced the water down still more into the *pelvis*, by means of a belly-band, the patient must be laid upon the edge of the bed, her thighs separated, the trocar and canula introduced into the *vagina* on the forefinger of the left hand, and then thrust into the most fluctuating part. In encysted dropsy, after the swelling has been made very tense by placing a folded towel upon the belly above and below it, the trocar must be introduced at the most fluctuating part. If the water be contained in several sacs, it should be attempted, after introducing the trocar into one of them, withdrawing the stilette and drawing off the water, to press the other sacs against the inlying canula, and with the trocar again introduced to open them; or they should be severally punctured.

[Among the variety of schemes proposed for the cure of dropsy in the belly, the ingenious one of BUCHANAN (*b*) is worth adverting to, though it was not successful. His object was to ascertain the effect of a communication between the cavity of the *peritonæum* and that of the bladder, for which purpose he employed a curved trocar, similar to that commonly used in retention of urine. He first introduced the canula through the *urethra*, towards the upper and fore part of the bladder, pushing it as far as possible up, to keep the coats of the bladder stretched; and then passing the trocar through it, without difficulty punctured the bladder, and, withdrawing it, the water flowed freely. The aperture closed within a fortnight, and the operation was again resorted to, but with the same result. About a fortnight after, the operation was repeated, but with no better success, and was therefore given up.]

1921. Of all dropsies, that of the ovary is the most common. The fluid is of different nature, colour, and consistence, is contained either in one or several sacs, the walls of which are of different thickness. In most cases, this dropsy is accompanied with other degenerations and diseased productions of the ovary, hydatids, steatomatous, and sarcomatous changes, bony, stony, and other concretions.

The *diagnosis* of dropsy of the ovary is often difficult when the distension is very great. The following circumstances may direct the practitioner: the swelling begins at one particular spot, on one or other side, at which there is often weight or painful feeling for a long time, often after the stoppage of the menses, often after suppression of discharges from the generative organs. With considerable distension, there is also often observed an irregular condition of one or other side of the belly, and, at some parts, a resisting hardness. The state of the general health is usually less disturbed than in *ascites*. The situation of the vaginal part of the womb is

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(*a*) WATSON, HENRY, A Case of Ascites, in which the water was drawn off by tapping the Vagina; in Medical Communications, vol. i. p. 162. London, 1784.

(*b*) Glasgow Medical Journal, vol. i. p. 195. 1828.

mostly changed, and dragged to one or other side. If the water be collected in several sacs, or there be also other kinds of degeneration, the swelling can be only partially emptied by the puncture, and is then more distinctly felt, and may even be displaced. But if, with ovarian dropsy, there be also *ascites*, the kind of disease and the contents of the belly can only perhaps be determined after previous tapping. Both ovaries are rarely dropsical at once; and the left is more frequently so than the right.

According to BLASIUS (*a*), ovarian dropsy appears under three forms, as *hydrops hydatidosus*, *saccatus*, or *cellulosus*. In the first form, a number of hydatids are found beneath the serous membrane of the ovary; in the second, the water is collected in a distinct sac beneath the serous membrane; in the third, it is contained in numerous cells within the substance of the ovary. These cells are originally Graafean vesicles, have thick walls, but in which openings are often formed by the pressure of the water, so that several cells communicate together, or even tear on the surface next the cavity of the belly, and discharge the water into it; or, in rare cases, when the Fallopian tube has its open end applied to the ovary, the water escaping by the tearing of the corresponding cell is discharged through the tube into the womb, and escapes by the *vagina;* in which case, the patient, from time to time, loses a pale or discoloured bloody stinking water, by which the swelling of the ovary is at the same time remarkably diminished, and the inconvenience, which it had at first caused, frequently subsides. Any immediate external violence is not necessary to cause this. BLASIUS has collected examples of this kind, and has distinguished it as *hydrops ovarii profluens*.

1922. As puncturing an encysted dropsy, and especially that of the ovary, is only a palliative, various modes of proceeding have been proposed for the *radical cure*. After making the puncture, the canula of the trocar should be left in, to diminish the size of the sac, and then by enlarging the wound to excite adhesive inflammation, or by introducing a flexible tube to keep up the discharge. OLLENROTH (*b*), after first making the usual puncture, thrusts in a round-ended tube through the former, leaves it there some days, empties the fluid several times a day, and applies moderate pressure on the belly. LE DRAN (*c*) made an opening into the sac upon a director introduced through the trocar canula, or immediately upon it, to the extent of four or five inches, held the wound open, and endeavoured by injection or by the introduction of wadding to destroy the sac, or bring about its growing together. LITTRE (*d*) effected this by injection. CHOPART and DESAULT (*e*) opened the sac with caustic, by which it gradually flaked off. DZONDI (*f*) opened the sac with a cut, passed in a bougie, and separated the loose sac with forceps. KING (*g*), WEST (*h*), and JEAFFRESON (*i*), puncture the swelling and enlarge the wound, or make a cut on a fold of the wall of the belly, open the *peritonæum*, carry a ligature through the exposed cyst, empty it with a puncture, draw the swelling gently forward, put a ligature around its stalk, cut off the sac in front of the ligature, and then unite the wound. But when there also exists degeneration of the ovary, or complete steatomatous alteration, in which the former modes of treatment can have no satisfactory result, for the purpose of effecting a radical cure, DE LA PORTE and MORAND (*k*) proposed the extirpation of the diseased ovary; and L'AUMONIER (*l*),

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(*a*) Commentatio de Hydrope Ovariorum profluente. Halce, 1834.

(*b*) RICHTER, Anfangsgründe, vol. v. p. 165–170.

(*c*) Mémoire de l'Acad. de Chirurg., vol. ii. p. 431.

(*d*) Mém. de l'Acad. des Sciences. 1707, p. 502.

(*e*) Œuvres Chirurgicales, vol. ii. p. 238.

(*f*) Beiträge zur Vervollkommung der Heilkunde, vol. i. Halle, 1816.

(*g*) Lancet, 1836–37, vol. i. p. 586.

(*h*) Ibid., 1837–38, vol. i. p. 507.

(*i*) Transactions of Provincial Medical Association, vol. v. p. 239. 1837.

(*k*) Mém. de l'Acad. de Chirurgie, vol. ii. p. 452 p. 455.

(*l*) Hist. de la Soc. Roy. de Médecine, vol. v. p. 296. 1782.

Smith (*a*), Lizars (*b*), Chrysmar (*c*), and Quittenbaum (*d*), have successfully performed it. The practicability of this operation depends on the usually thin stemmed attachment of the dropsical and otherwise degenerated ovary, which is merely formed by the broad ligament, and has usually no considerable adhesions. The wall of the belly must be cut into on one side or the other of the white line, according to the seat of the swelling, and to a corresponding length, in which the protrusion of the intestines must, as in the Cæsarean operation, (*par.* 1844,) be prevented. The swelling is now carefully separated from whatever attachment it has to the *omentum*, the *peritonæum*, and so on, with the fingers or with the knife, and drawn out through the wound; the now apparent thin stem is pierced near the womb with a needle, and tied by means of a double thread, to prevent the ligature slipping off. The stem is then cut through before the ligature, which is brought out at the bottom of the wound, which is to be united after the rules above given for the Cæsarean operation.

(1) Here also must be noticed Recamier's (*e*) mode of treatment; the swelling is emptied with a flat trocar, the canula thrust into the blind end of the *peritonæum* till it is felt in the *vagina*, into which it is thrust, and an elastic tube introduced. The result was fatal.

[(2) Brown (*f*) advises a combined constitutional treatment, with tapping and very tight bandaging. He sums up the principal points in the successful treatment of the four cases he has given in the following words:—"I shall divide the treatment into constitutional, local, and treatment after tapping. *First*, constitutional; mercurials administered internally, as alteratives, and externally by friction over the *abdomen*, and continued till the gums are slightly yet decidedly affected, and this affection must be continued for some weeks. I lay particular stress upon this point. At the same time diuretics must be given, and after the first week tonics should be combined with them. The food should consist of light animal diet, and should be unstimulating, and the patient should take daily exercise in the air. *Second*, local treatment; the careful and constant application of *tight flannel bandaging*, so as to procure considerable pressure over the tumour. When it is proved that the abnormal action has been checked by a positive decrease of the tumour, and a continuation of such decrease, or by a positive *non-increase* for some weeks, then the cyst should be tapped, and its fluid evacuated. *Third*, after-treatment; accurate padding (napkins folded in a square form and placed one over the other, so as to form a firm pad) and *tight* bandaging over the cyst and belly generally, for two or three weeks after tapping, and the medicine and friction continued for at least six weeks. I would particularly wish to enforce the importance of the after-treatment, as on that depends very much the success or failure of the case." (p. 181.)

Bonfils (*g*) and Camus (*h*) recommend, that after puncturing the cyst and withdrawing the water, the canula should be briskly moved in different directions, to bruise and even tear the wound in the walls of the cyst, to prevent the adhesion of its edges, and allow the continual escape of the fluid into the cavity of the *peritonæum*, where it will be absorbed. Bérard, however, thinks that the movements of the instrument rather excite adhesive inflammation and obliteration of the sac.

(3) With regard to the advantage derived from tapping an ovarian dropsy, Southam (*i*) observes, from the analysis of twenty cases which he recites, "that *paracentesis*, which is generally considered the most effectual palliative, not only affords a very temporary relief, but is by no means unattended with danger. Thus fourteen died within nine months after the first operation, four of whom survived it only a few days. Of the remaining six, two died in eighteen months, and four lived for periods varying from four to nearly nine years. It further appears that *paracentesis* does not prolong

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(*a*) Edinburgh Med. and Surg. Journal, vol. xviii. p. 532. 1822.

(*b*) Observations on the Extraction of Diseased Ovaria, p. 9. Edinburgh, 1825, fol.

(*c*) In Hopfer, Ueber Exstirpation krankhafter Eierstöcke; in Graefe und Walther's Journal, vol. xii. p. 60.

(*d*) Quittenbaum, C. F., Solemnia Christi nate precelebranda indicit. Inest Commentatio de Ovarii hypertrophia et Historia Extirpationis Ovarii hypertrophici et hydropici prospero cum successu factæ. Rostochii, 1 35. 4to.

(*e*) Revue Médicale, vol. i. p. 19. 1839.

(*f*) Cases of Ovarian Dropsy, &c.; in Lancet, 1843-44, vol. i.

(*g*) Gazette Médicale, vol. xi.

(*h*) Ibid., vol. xiii.

(*i*) London Med. Gaz., vol. xxxii. p. 732. 1843.

life on an average for more than eighteen months and nineteen days; and that one in five dies of the first operation. Another fact to be gathered from the table is, that the *peritonæum* being more prone to inflammatory action in some persons than in others, repeated tappings, instead of proving barriers to extirpation, show that (other circumstances favourable) there is much less risk of inflammation following the operation (of removing the ovary.)" (pp. 237, 38).]

The operations now generally performed for the extraction of dropsical or otherwise diseased ovary, are distinguished by the names, the small and the large operation.

The *small operation* was evidently suggested by Dr. William Hunter (*a*), who observes:—"If it be proposed, indeed, to make such a wound in the belly as will admit only two fingers or so, and then to tap the bag and draw it out, so as to bring its root or peduncle close to the wound of the belly, that the Surgeon may cut it off without introducing his hand, surely in a case otherwise so desperate, it might be advisable to do it, could we beforehand know, that the circumstances would admit of that treatment." (p. 45.)

This operation was performed first and with success by Jeaffreson (*b*) of Framlingham, in Suffolk, in 1836, and consisted in "an incision of between ten and twelve lines in the course of the *linea alba*, midway between the navel and the *pubes*, and having thus carefully exposed the sac he evacuated by the trocar, about twelve pints of clear *serum*. During the flow of the *serum*, a portion of the sac was secured in the gripe of a forceps, to prevent its receding; and he afterwards extracted the sac entire from the cavity of the *abdomen*, together with another sac containing two ounces of fluid; indeed the entire ovary, having only to cut through a slight reflection of the *peritonæum* and ovarian ligament, which, with the exception of a small portion of the fimbriated extremity of the Fallopian tube, are the only natural attachments of the ovary to the *uterus*. But as this part was the medium of vascular supply to the sac, and the vessels on the surface of the sac were unusually large, but he thought right to include it in a ligature previous to returning it into the cavity of the *abdomen;* the ends of the ligature were cut off close to the knot." (p. 242.) In King's case (*c*) in which the same operation was performed, it was necessary, "towards the termination of the extraction, that the opening be enlarged to above three inches; and the obstruction which rendered this requisite, consisted of a solid tumour of about two and a half inches in diameter." (p. 589.) West's was the third case, and he made a cut of two inches long in the *linea alba*, an inch below the navel.

The *large operation*, as practised by Macdowall of Kentucky, Lizars and Clay, is described by the latter (*d*) as "a large incision of eighteen or twenty inches in length, or from the ensiform cartilage to the *pubes*, the ovarian tumour is fully exposed, its pedicle and adhesions separated, its vessels secured, and the whole mass removed entire." Walne (*e*,) who follows the same practice, after having made a small opening of an inch and a half in length below the navel, for the purpose of ascertaining the existence of any adhesions which may prevent the propriety of proceeding with the operation, makes a cut of about thirteen inches, leaving a space of three inches from the pit of the stomach, and another an inch and a half from the *pubes* undivided. He advises, also, that the skin should be marked with lunar caustic across the *linea alba*, previous to the operation, so as to ensure its proper re-adjustment afterwards.

The preliminary treatment consists in abstinence from animal food, and a general antiphlogistic regimen a few days previous to the operation, and Bird strongly recommends attention to the temperature of the room which was kept at 85° Fahr., and gradually lowered as the patient became convalescent.]

1923. In the critical examination of these various modes of treating encysted dropsy, especially that of the *ovarium*, the following circumstances must be borne in mind:—that in all cases in which the disease does not cause great annoyance, any operation is to be considered unallowable, as frequently the tumour, when it has reached a certain bulk remains stationary, and the patient may live for a long while; but by the puncture there is only short relief, as the fluid generally re-collects so much the quicker the oftener it is punctured. Sometimes life is much prolonged by repeated

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(*a*) Remarks on the Cellular Membrane and some of its Diseases, in the History of an Emphysema; in Med. Obs. and Enq., vol. ii. 1762.

(*b*) Above cited.

(*c*) Above cited.

(*d*) Cases of Peritonæal Section for the Extirpation of Diseased Ovaria, by the large incision, &c.; in Medical Times, vol. vii. pp. 43, 59, 67, 83, 99, 139, 153, 270.

(*e*) Removal of a Dropsical Ovarium entirely by the large operation. Two pamphlets, 1834.

tapping, but at other times fatal inflammation soon comes on. Only in extremely rare instances does the puncture produce a radical cure (*a*). Fortunate results have indeed been published of cutting into, injecting the sac, and the like, but in the greater number of cases the result has been unsuccessful (1). The same also applies to extirpation, which, however, if the radical cure be undertaken in *degenerated*, hypertrophied ovary, when the position and attachments of the swelling are well made out (2), may be considered as the operation most to be depended on, and its frequent performance with success does away with Boyer's (*b*) doubt of the possibility of carrying it into practice. In like manner, in dropsy of the ovary without other degeneration, the operation of opening the wall of the belly with a small cut, drawing out the cyst when emptied, and carefully cutting it off, after putting a ligature around its stem, (King, West, Jeaffreson,) appears preferable to all the other methods proposed for a radical cure, and is supported by the successful cases published, as well as the fact, that such tumours, often even when of great size, contract no adhesions with the *peritonæum*. On the other hand, it has been objected that although this operation at the first glance appears safest and easiest, as only a small cut is required, and the bowels are subjected to less serious influences, these advantages may be outweighed by the difficulty of drawing the large mass through a small wound so as to reach and tie its stem; whilst the large cut puts the patient in no greater danger of inflammation than the small one, and has the advantage of getting at the stem with certainty, and of drawing out the tumour without danger. This objection cannot be assented to, as in dropsy of the ovary, unaccompanied with other degeneration and adhesions, the smaller cut presents indisputable advantages, and therefore the advice is good, always to make first a small cut between the navel and the *pubes*, so as to ascertain if there be any adhesions (*c*) (3).

(1) The puncture of an hydropic ovary through the *vagina*, cutting into the sac, and the various kinds of injection, are always followed, according to Callisen, with a fatal result (*d*).

(2) Martini, in one instance, found it impossible to draw out the tumour to its base (*e*).

[(3) As to the preference of the small over the large operation, or the contrary, much must depend upon the character and size of the diseased ovary, and which can only be decided in the course of the operation. It would seem, however, only reasonable, after making the exploratory cut for the purpose of ascertaining whether the tumour be free from adhesions, first to attempt its removal by the small cut, and afterwards to enlarge it, if necessary.

The results of the published cases of both the small and large operation have been, as far as possible, collected by Phillips, Jeaffreson, and up to the present time (July 1846) by T. Safford Lee, who has recently received the Jacksonian prize for a very able paper "*On Tumours of the Uterus and its Appendages*," not yet published, but from which he has kindly furnished me with the most perfect account yet obtained; which, however, is only perfect comparatively, as one of the persons who is believed to have operated on the greatest number of cases in this town at present has not made known the results of his experience.

It appears from Phillips's (*f*) table, that of the *forty-five* cases in which the large cut and the removal of the tumour entire was practised, the number of successful cases was only *eighteen*; whilst of the *twenty-five* in which as much of the contents of the sac were withdrawn as was possible, and the small cut only used, *twelve* succeeded.

(*a*) Boyer, Traité des Maladies Chirurgicales, vol. viii. p. 436.

(*b*) Boyer, Traité des Maladies Chirurgicales, vol. viii. p. 438.

(*c*) Systema Chirurgiæ, vol. ii. p. 71. — Vermandois; in Journ. de Médec., par Sedillot, vol. xlvii. p. 150. 1813.

(*d*) Rust's Magazin, vol. xxviii. p. 436.

(*e*) Key; in Guy's Hospital Reports, Second Series, vol. i. p. 473. 1843.—Southam, above cited.

(*f*) Med.-Chir. Trans., vol. xxvii. p. 473. 1844.

Of the *seventy-four* cases of the operation for the removal of ovarian tumours which had been published up to October, 1844, and have been collected by JEAFFRESON (*a*), it appears, according to his analysis, that "in *thirty-seven* cases the tumour was removed, and the patients recovered. In *twenty-four* cases the operation was followed by the death of the patient; of these twenty-four fatal cases, the tumour was removed in *fourteen*, could not be removed on account of adhesions in *six*, and was found to be other than ovarian tumour in *four* cases. Thus again in *seventy-four* cases in which the operation for extraction of ovarian tumour has been undertaken, it has been completed in *fifty-one* instances, in *fourteen*, out of which *fifty-one*, it has been followed by death, and in *thirty-seven*, by the successful removal of the tumour and the recovery of the patient; whilst out of the *seventy-four* cases selected, it was found impossible to carry out the intentions of the operator in *twenty-three;* or in other words the *diagnosis* was not sufficiently accurate to enable the Surgeon to foresee the impracticability of carrying out his intentions. Of these *twenty-three* cases, *thirteen* recovered with life to remain in *statu quo;* and *ten* died. The cause of failure was impossibility of removing the tumour on account of adhesions in *fourteen* cases. No tumour was found in *three* cases; and the tumour proved to be other than ovarian in *six* instances. (p. 648.)

LEE states to me "the actual number of cases in which the peritonæal cavity has been performed is *one hundred and eight* (commencing with L'AUMONIER's case.) Of these *seventy-nine* were operated upon by the large incision, *twenty-three* by the short, and in *six* cases the length of the incision is unknown. The mortality in these patients is as *one* death to nearly *three* recoveries—namely, *sixty-nine* recovered and *thirty-nine* died. The operation was not completed in *twenty-four* out of the *one hundred and eight* cases, either on account of adhesions or no tumour being found. Of the *eighty-four* cases where the operation was performed with a fair chance of benefit, *fifty-three* recovered and *thirty-one* died, making as 1 death to $2\frac{22}{31}$ recoveries. Of the *seventy-nine* patients operated on by the long incision *forty-five* recovered and *thirty-four* died, making the mortality as 1 death to $2\frac{11}{34}$ recoveries. Of the *twenty-three* operated on by the small incision *nineteen* recovered and *four* died, or 1 death to $5\frac{3}{4}$ recoveries. From these facts we learn that this operation terminates frequently fatally; that a correct *diagnosis* is very difficult, and in many instances defective; and that the short incision has been used more successfully than the large."

Much difference of opinion still exists as to the propriety of subjecting a female to such imminent danger, as, without doubt, she must incur, in undergoing the operation of the removal of a diseased ovary. In addition to which, much has been said in reference to the malignant character of the disease, which if it were really so, would justly forbid it being meddled with. SOUTHAM says, that "having carefully examined several specimens of dropsical *ovaria*, he is inclined to believe that they never present a truly scirrhous character; on the contrary, that they generally consist of simple cysts, or partake of what is called cystic sarcoma (*b*), for the development of which, the peculiar structure of the ovary appears highly favourable." (p. 238.) The proneness of both ovaries to be diseased has also been brought as an objection to the operation. But SOUTHAM says:—"I have carefully examined the records of twenty-nine cases of true dropsical *ovaria*, and found that there were but two in which the opposite ovary presented a *decidedly* abnormal character. Where, however, the disease was malignant, both were affected in three cases out of four." (p. 240.)

It is also held by some, that the patient has a chance of recovery, without the risk of an operation, by the cyst bursting of itself, and the discharged fluid being absorbed from the general cavity of the *peritonæum*. Such bursting of the dropsical ovary does now and then occur, but favourable issue is very rare. One case of this kind, in which, after several burstings, and the woman recovered, is related by BONFILS (*c*). Another occurred recently to CAMUS (*d*), in an old woman of eighty-five, who had had ovarian dropsy for two years and a half. She was then attacked with severe pain in the swelling, attended with extreme lassitude, shivering, and slight fever; on the following day, she had severe pain in the belly, with nausea, vomiting, great restlessness, colic, quick small and hard pulse, and anxious countenance as in *peritonitis*. The shape of the belly was completely altered; instead of projecting, it was flattened in the centre, but had gained in size what it had lost in prominence. The fluctuation from one side to the other had never been so distinct before. A few days after she began to void large quantities of urine, and in less than a fortnight the existence of fluid in the belly was no longer apparent. Reaccumulation, however, came on, and the belly became larger than before; but at the

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(*a*) London Med. Gazette, vol. xxxv. 1844.

(*b*) HODGKIN; in Med.-Chir. Trans, vol. xv. p. 265. 1829.

(c) Gazette Médicale, vol. xi. p. 746. 1843.

(*d*) Gazette Médicale, vol. xiii. p. 158. 1845, and RANKIN's Half-yearly Abstract of the Medical Sciences, vol. ii. p. 151. 1846.

end of six months the cyst burst, and the water subsided as before. The belly again filled, and at the end of four months and a half the cyst burst the third time, with less severe symptoms, and the patient recovered. Dr. LOCOCK informs me, that he has at present under his care, with Sir BENJAMIN BRODIE, a female about fifty years of age, in whom the ovarian cyst has burst several times. About a year and a half ago, long before any tumour was discovered, she had about once in six weeks an attack of violent abdominal spasms, of the same nature as those which have since clearly been connected with the bursting of the cyst. These attacks became gradually more frequent, latterly once in three weeks. The first discovery of the tumour was about six or seven months ago, a globular elastic tumour of the size of an orange; but previous to this being felt above the *pubes*, a very distinct elastic tumour was perceived by examination by the *vagina*. Suddenly spasms came on as before, and the tumour was gone, which led LOCOCK to think it was not an ovarian cyst, as he had previously called it, but only a collection of *flatus* in the bowel, as great eructations and general abdominal distension always followed the attacks. After several repetitions of the rise of the tumour gradually, the spasms, and the dispersion, it was noticed that the tumour became larger and larger each attack. Then BRODIE detected, after the dispersion, slight fluctuation in the abdominal cavity, which soon disappeared. The next time it filled, being then the size of a shaddock, they punctured it with a very fine trocar and drew off a few ounces of brown fluid, exactly the same as usually found in ovarian cysts. After this, firm pressure was tried, for a week or two, over the tumour, but she could not bear the pain it produced. Since this, the same alternate filling, bursting, spasms, and disappearance have returned at still shorter intervals, and recently her health has begun to fail. The extreme rarity of these favourable results, however, can scarcely be allowed as argument against the operation.

CAMUS, from the inquiries he was led to in reference to his own case, has obtained some very interesting conclusions: *first*, that in the rather great number of cases which died immediately, or within a few days after the first bursting, the cyst had, previous to its rupture, contained a purulent fluid, more or less altered, and not the usual serum. *Second*, that others, after one or more burstings, *ascites* remained, though it was not proved that the *ascites* and the dropsy of the ovary had not existed at the same time. *Third*, that most of the patients, who survived one or two burstings, were cured only for a time, and at last sank under the progressive effects of the encysted dropsy. (p. 158.)

ASTLEY COOPER mentions two instances in which the ovarian cyst was burst by accident; in the one, the patient was thrown out of a one-horse chaise, and the disease seemed to have been cured, but it returned seven years after, and she was obliged to be tapped; the other patient fell out of bed on the corner of a chair, she afterwards passed large quantities of urine, but the disease returned. (p. 375.) But besides the very rare cure of ovarian dropsy by bursting into the general cavity of the belly, the cyst also very rarely bursts into the fallopian tube, and the water is discharged through the womb. ASTLEY COOPER mentions a case of this kind; and also another in which it burst into the intestinal canal; and though the patient was subject to occasional returns of the disease, she ultimately recovered. (p. 385.) SCHMUCKER (*a*) also says, that in one case, after the sixteenth tapping, the ovary became suddenly extremely painful in one night, and was followed by the discharge of a large quantity of very stinking ichorous matter through the womb, which continued for some days, and then ceased. (p. 196.)

ASTLEY COOPER relates a remarkable instance, in which the navel ulcerated, and large quantities of water were discharged for a considerable time, but ultimately closed, and the disease did not return. (p. 384.) Similar to this, though the opening was artificial, is the case of a female of forty-three years of age, who was tapped for ovarian dropsy by my friend SUTTON, of Greenwich, in 1821, and three or four times after; on each occasion some hair passed through the canula, and at the last operation, he determined to lengthen the cut downwards, so as to empty all the hair, which he effected. A portion of bougie was kept in by his direction for some months, when the discharge ceased; but the lady fearing the fluid might re-collect, continued the bougie in the wound till her death, of apoplexy, in 1841.

In concluding this important subject, it will not be improper to give the opinions of two able practitioners against and in favour of this operation, about which there is still so much difficulty in deciding.

ASHWELL (*b*) observes:—" If the operation is to become established, of which I have the strongest doubt, it must be confined to examples of the malady where tapping has been already so often performed as to preclude, from the experience of similar cases,

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(*a*) Chirurg. Wahrnehm., vol. ii.
(*b*) Practical Treatise on the Diseases peculiar to Women 1844. 8vo.

any idea that it can ever be dispensed with; and where we are confident that great suffering must lead to early death. Perhaps this may be regarded as too limited a view of the value of extirpation, but it is, I think, the correct one. In such cases, if the *diagnosis* excludes the belief that there are serious adhesions, or malignant and solid growths complicating the tumour, and, if the patient strongly desires it, the operation is defensible. In all other examples, it can only rest on the patient's own views of her future prospects, and on a calculation of chances. She might live many years, and without much suffering; she may die in a few years, after great suffering; she determines, therefore, being courageous, and probably strongly urged by her Surgeon to run the risk of immediate death, for the hope of immediate and radical cure. Whether she has done wisely to submit to such a hazard, a successful operation can scarcely prove; that she has happily secured her safety, through imminent peril, such an operation does prove." (p. 648.)

On the other hand, Southam (*a*) says:—"The operation is perfectly justifiable when the patient's sufferings are such as to make her life a burden to her; when the symptoms of structural lesion of any important organs are absent; and when the constitution is suffering merely from functional derangement consequent upon pressure of the tumour on the neighbouring parts. On the contrary, it ought not to be attempted when the well-known characteristics of malignant action are present; when the tumour is solid, uneven, and has been of rapid growth; when the glands in the vicinity are enlarged, and hard knots can be felt in different parts of the *abdomen*, or when there is distinct evidence of other organs being similarly implicated. Still less should it be undertaken until the Surgeon, by varied and repeated examinations, is convinced of the existence of the disease. Nor must the rules, which direct us as to the propriety of operating in other diseases, respecting the condition of the sexual organs, and the fitness of the patient's constitution to undergo so severe an operation be overlooked." (p. 241.)

The number of times which a patient may bear tapping is almost incredible; three, four, and five times are by no means unfrequent.

Schmucker (*b*) mentions a woman of forty-five, on whom he operated twenty-nine times in four years; Ford (*c*) forty-one times in four-and-a-half years; Schmucker (*d*) on another woman, sixty years old, fifty-two times in four years. Mead (*e*) sixty-five times in sixty-seven months; Callisen (*f*) one hundred times; in Dartford churchyard "lies the body of Ann Mumford, &c. Her death was occasioned by a dropsy, for which, in the space of three years and ten months she was tapped one hundred and fifty-five times. She died 14th May, 1778, in the 23rd year of her age" (*g*). But Bezard's (*h*) case exceeds all, a woman who, he says was tapped six hundred and sixty-five times in the course of thirteen years. Whether these cases were *ascites* or encysted generally, is not mentioned. The quantity of water drawn off, varies of course according to the size of accumulation; and whether the tapping be repeated frequently, and before the belly has recovered its former size. In the second case, recited above from Schmucker, the quantity had been reduced to five pints; and in the greater number of these operations, three or four quarts only was the quantity withdrawn. Astley Cooper says:—"The smallest quantity he had removed was eight quarts, and the largest twelve gallons and a pint, from an ovarian dropsy, the cyst of which is now in St. Thomas's Museum." Stoerck took away twelve gallons and a half. "The proportion averages," says Astley Cooper, "from twenty-five to thirty-two pints," (p. 374,) and this upon the whole, I believe, a fair estimate.]

Besides the writers already mentioned, the following may also be consulted in reference to puncture and removal of the ovary:—

Sacchi, Memoria sull' Idrope delle Ovarie e sulla loco estirpazione; in Omodei, Annali universali di Medicina, vol. lxiii. p. 257. 1832.

Chelius; in Heidelberg. Annalen, vol. i.

Hevin; in same.

[Dohlhoff (*i*) operated successfully by the large incision on a large tumour, which turned out to be a cyst, containing nine and a half pints of purulent fluid, so closely connected with the under surface and thin edge of the liver and the intestines, that its removal could not be attempted. Having discharged the pus, he filled it with charpie, and subsequently stimulated it with *ung. elemi* and injections of *liq. hydr. nitr.*, and added Peruvian balsam and tincture of myrrh to the ointment. At the end of two months

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(*a*) Above cited.

(*b*) Above cited, vol. ii. p. 202.

(*c*) Medical Communications, vol. ii. p. 123.

(*d*) Above cited, p. 187.

(*e*) Medical Works, p. 394. Dublin, 1767.

(*f*) Syst. Chirurg. Hodiern, vol. ii. p 55.

(*g*) A. Cooper's Lectures, vol. ii. p. 374.

(*h*) Bullet. de la Soc. Med. d'Emulation, vol. ii. p. 495. 1815.

(*i*) Caspar's Wochenschrift, vol. i. p. 513. 1833.

the discharge had nearly ceased, and she shortly after returned to her occupation of midwife.]

1924. If dropsy of the belly accompany pregnancy, either at the onset or during the middle of its course, very considerable uneasiness is produced by the great distension of the belly, by the great swelling of the lower limbs, and by the pressure which the bowels suffer; breathing is much interfered with, and at last death-like agony, and danger of suffocation ensue.

1925. If pregnancy be connected with acute *ascites*, the regular form of the *fundus* and body of the womb cannot be distinguished by the touch, specially on account of the enormous distension and projection of the *hypochondria* caused by the quantity of fluid driven up towards the *diaphragm* between the *fundus* and back of the womb, and the bowels. The urine is scanty, and the perspiration ceases. In examining the dropsy of the belly, a fluctuation of water is felt, indistinct in the *hypogastrion* and on the sides, but perceptible and distinct enough in the *hypochondria*, decidedly so and vibrating in the left *hypochondrion* between the upper and outer edge of the *m. rectus abdominis*, and the edge of the false ribs.

1926. This place appears to be most fitting for the performance of *paracentesis*, without running the danger of wounding the womb or the intestines (*a*). It is less proper to make the puncture at the usual place, whilst an assistant with both hands presses the womb towards the spine, thus forming a thick fold of skin, which is either perforated with the trocar (*b*), or previously opened with a cut made through the wall of the belly (*c*).

1927. A *collection of Water in the cavity of the Womb* (*Hydrops Uteri*, *Hydrometra*) may exist in that organ when it is either unimpregnated or impregnated. In the former case it comes on with painful feelings about the *pudenda*, numbness of the feet, irregular menstruation and whites, a cold swelling in the region of the womb, spreading also over the lower part of the belly, in which, on careful examination, a fluctuating movement can be perceived. The patient has a feeling of cold over the whole extent of the womb, of its dropping to one side, and when she lies down. If the swelling be in itself very large, there is pain, indigestion, qualmishness, vomiting, frequent flatulence, colic, costiveness, difficulty in making water, retention of urine, at last great wasting and hectic fever. Sometimes the water is discharged by the *vagina* from time to time, accompanied with agony and labour-like pains. This discharge is not unfrequently periodical.

The signs of distinction between this kind of dropsy and pregnancy are, the enlargement of the tumour without regularity; its cold, fluctuating feel; the mouth of the womb is thin, tense, and contracted, and does not rise after the third month; its occurrence in girls not arrived at puberty, or in old women, who throughout their whole life have been unfruitful; the breasts are generally withered and contracted, though the contrary is also observed. The absence of the child's motions and of the audible beating of the heart; and, in some cases, the existence of the disease for more than nine months confirms the *diagnosis*.

1928. In *dropsy of the pregnant womb*, which may be accompanied

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(*a*) Scarpa, Memoria sulla gravidanza susseguita da Ascite, ed osservazioni pratiche su i avantaggi della nuova maniera d'usare la paracentesi dell'addomine in simili casi. Treviso, 1817. 8vo.

(*b*) Viesseux, On Tapping during Pregnancy; in London Medical and Physical Journal, vol. vii. p. 40. 1802.

(*c*) Bonn, Ueber die Harnverhaltung, p. 31.

with *ascites*, the belly soon acquires as regular distension as at the end of pregnancy, on striking the belly nothing more is felt than a slight, deep, dull fluctuation ; the quick distension of the womb, the bowels violently thrust up against the *diaphragm*, in consequence of which there is difficulty of breathing, and even danger of suffocation ; the feet generally swell. A considerable quantity of water is not unfrequently passed, from time to time, often periodically by the *vagina*, with symptoms of threatening abortion. The birth, however, usually occurs at the due time, and after the discharge of the proper waters. The seat of this dropsical accumulation is either between the womb and the fœtal membranes, between the *chorion* and *amnion*, often probably in a proper sac; or there may be a very considerable collection of the *liquor amnii*. The *placenta* also may be affected with hydatids during pregnancy. An hydatidous degeneration of the *ovum* may even produce an accumulation of water in the womb, and render the *diagnosis* extremely difficult (*a*).

1929. The *causes* of dropsy of the unimpregnated womb are, closing of the mouth of the womb by spasm, its stopping up or growing together, and a diseased condition of the secretion of its inner surface. The removal of the water is effected either by the use of the remedies specially employed for dropsy, which act upon the kidnies, the alimentary canal, and the absorbing vessels ; or if the mouth of the womb be closed, by warm or steam baths, softening injections, or by the introduction of a female catheter into the mouth of the womb when it is stopped up with plugs of lymph, and the like. If there be adhesion of the mouth of the womb, the above-mentioned remedies are useless ; if the symptoms be severe, as when dropsy of the womb accompanies pregnancy, danger of suffocation, and the like, *paracentesis uteri* is required.

1930. This operation, when the mouth of the womb is closed, is performed as already described, (*par.* 1823,) or between the navel and the *pubes*, the bladder having been previously emptied and a belly-band applied ; or above the vaginal portion of the womb, in the fluctuating part of the tumour, with a trocar (*b*).

1931. In *distension of the alimentary canal with air*, (*Tympanitis*,) the operation of *paracentesis* has been proposed by some Surgeons, if the ailment be idiopathic and not a symptom of any other disease, if it have existed three or four days, have withstood all remedies, and the patient be exceedingly restless and distressed ; the pulse strong and quick, not small and soft ; and there be general heat over the whole body unaccompanied with coldness of the limbs. Other practitioners have decidedly opposed such treatment.

In performing the operation a long thin trocar with a canula perforated on the sides, is thrust into the middle of a line drawn on the left side from the front end of the second upper false rib to the front iliac spine, to the depth of four or five inches, which directly opens the *colon descendens*. The trocar is then withdrawn, whilst the canula is held in, and the air contained in the bowel escapes, after which the tube is to be removed as already directed. The patient should take but the smallest quantity of drink, indeed only a little iced almond milk, and his thirst quenched with a slice of Seville orange, sugared, and kept in his mouth, or with a cool

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(*a*) SCARPA, above cited.—CRUVELHIER, Essaies sur l'Anatomie pathologique en général, vol. i. p. 280. Paris, 1816.—GERIL, (Præside NAEGELE,) Dissert. de Hydrorrhœa Uteri gravidi. Heidelb., 1821.

(*b*) SCARPA, above cited. — DEVILLIERS ; in Journal de Médecine, par SEDILLOT, vol. xliii. 1812.

rather than a lukewarm bath. If there be no subsequent discharge from the bowel, purgative, and afterwards nourishing clysters may be given; and to relieve the loss of tone which the intestine for some time suffers, cold applications and swallowing small pieces of ice may be ordered (*a*).

IX.—OF HYDROCELE.

(*Hydrocele*, Lat.; *Wasserbruch*, Germ.; *Hydrocèle*, Fr.)

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Blandein, Art., *Hydrocele*; in Dict. de Médecine et Chirurgie Pratiques, vol. x. p. 108.

(*a*) Combalusier, F. P., Pneumotopathologie. Paris, 1747.—De Marchi; in Brerer, Giornale, 1813.—Levrat; in Nouvelle Bibliothèque Médicale. 1823.—Zang, Operationen, vol. iii. pp. 290, 291, 317.

1932. *Hydrocele* is a collection of watery fluids in the tunics of the *scrotum*, or of those of the testicle; it therefore varies according as the water is collected in the cellular tissue of the *scrotum*, in the vaginal tunic of the testicle, or in that of the spermatic cord. The latter two are, however, in general alone considered as hydrocele, and the former as *œdema*.

1933. The collection of water in the cellular tissue of the *scrotum* forms a soft swelling, which retains the impress of the finger, and when it enlarges, becomes tense and firm, unfolds the wrinkles of the *scrotum*, spreads on to the *penis* and covers it, and by the swelling of the prepuce, the discharge of the urine is often prevented. Inflammation, suppuration, and mortification may result from this swelling.

1934. This disease is either symptomatic and connected with general dropsy and the like, or arises from pressure on the lymphatic vessels by an ill-fitting truss, or from accidental tearing of a hydrocele of the vaginal tunic, and in children from pressure during the birth, and irritation of the *scrotum* by the urine. The cure depends on the removal of these causes and the use of means specially fitted to *œdema*.

1935. The collection of water in the vaginal tunic of the testicle, *True Hydrocele* (*Hydrocele tunicæ vaginalis testis*) is always produced slowly, as a swelling rising gradually from the bottom of the *scrotum* towards the abdominal ring, at first sometimes accompanied with painful distension, but at other times without any peculiar sensation. The swelling has generally an oval form (1), is elastic, tense, sometimes distinctly fluctuating, and the appearance of the skin over it is unaltered; in comparison with its size it is light; it increases neither on coughing nor on any exertion, and cannot be returned into the belly. The testicle is felt, when the swelling is large, generally on its upper and hind part as a hard part (2); its position, however, may vary. The spermatic cord is felt above the swelling, if it extend not to the abdominal ring. If in the dark a light be placed behind the swelling, it is found to be transparent, if the fluid contained within it be clear, and the vaginal tunic be not thickened. Sometimes when the distension is very great, the vaginal tunic and the cellular tissue upon it and the *m. cremaster* are thickened, the swelling feels harder, is not transparent, and no fluctuation is felt; the vaginal tunic may be even bony. In long-continued hydrocele the spermatic cord and the testicle are varicose, the testicle sometimes wasted. From pressure on the swelling, as in old bulky ruptures, the vessels of the cord are sometimes separated, and thrust either aside or in front of the swelling. If the swelling be very large, the veins of the *scrotum* swell, the skin inflames and sometimes ulcerates.

[(1) The general form of a hydrocele is pear-shaped, largest at bottom, and narrowing regularly upwards; but very often it is more oval, and sometimes even contracted in the middle, so as to assume an hour-glass appearance. Care must be taken, however, to ascertain that this hour-glass form is not caused by the existence of two hydroceles, one above the other, of which Astley Cooper mentions one instance, (p. 90,) and Brodie a still more remarkable one, in which "he drew off the water from the lower part, and in doing that emptied the upper part. The patient came to him a year afterwards and said he wished to have the water drawn off again. Brodie observed that the contraction of the hour-glass was narrower, and, on drawing off the water from the lower part, found that the upper one was not emptied, and was consequently forced to puncture that afterwards, so that it was evident what had been originally a partial contraction, in the course of a year had become a complete one." (p. 91.)

(2) ASTLEY COOPER says:—"The *testis* is generally placed two thirds of the swelling downwards and at the posterior part of the *scrotum;* pressure at that part gives the sensation of squeezing the *testis.*" (p. 87.) I think, however, from my own observation, that the testicle is generally situated still nearer the bottom of the swelling than stated even by COOPER.

The quantity of water in a hydrocele varies from twelve to sixteen ounces, but I have occasionally drawn off between twenty and thirty. The largest quantity on record is, I believe, that of the celebrated GIBBON the historian, from whom the elder CLINE drew off six quarts; and BRODIE says that he has "seen a hydrocele hanging down to the patient's knees." (p. 89.)

The serum of a hydrocele is generally straw-coloured and transparent, but sometimes so dark that the light of a candle held behind a swelling cannot be perceived. I have recently had a case of this kind, in which the serum was dark greenish-brown, and could not be seen through, though transparent, on account of its colour; the vaginal tunic itself was thickened, the hydrocele being very large and of long standing. Transparency, as a diagnostic mark, must therefore be received with some caution.

ASTLEY COOPER also mentions, that the serum "sometimes contains a quantity of white flaky matter, produced by chronic inflammation," and "when produced under acute inflammation, the fluid is sometimes of a red colour, from a mixture of red particles of the blood." He has also seen "in the fluid of hydrocele, loose bodies, of which there is a specimen in the Museum at St. Thomas's." (p. 92.)]

1936. Hydrocele of the vaginal tunic of the testicle is distinguished from scrotal rupture by the way in which it begins, and by the swelling enlarging neither by cough nor exertion, and from hardening of the testicle, by its elastic, uniform, painless fluctuating character, whilst the hardened testicle is hard, irregular, and painful. Hardening, swelling, and hydrocele of the testicle may exist at the same time (*Hydrosarcocele.*) Hydrocele has many resemblances to medullary *fungus* of the testicle, and sometimes the fluctuation at different parts may at first render the *diagnosis* difficult. The transparency of the hydrocele, when a light is held behind it in the dark, is in all cases to be considered as its most certain character.

[Hydrocele may be accompanied with either scrotal rupture or diseased testicle. The rupture-sac may descend as low as the hydrocele and no further, which is commonly the case when the two diseases exist together; but it may also descend behind the hydrocele, and the existence of the latter may not be noticed till strangulation of the rupture taking place, it is discovered during the operation. Cases of this kind have been already mentioned in speaking of the varieties of strangulated rupture. (*par.* 1199, *note.*) The diseased condition of the testicle itself is usually without difficulty made out, though imperfectly, before the operation for tapping the hydrocele is performed; but its nature cannot be easily discovered, and therefore the Surgeon must be guided by circumstances in regard to the steps he must take with it.—J. F. S.]

1937. The *causes* of hydrocele are in most instances unknown; it arises of its own accord in healthy subjects, and is especially frequent in children and old persons. Its cause often seems to be a slow inflammation of the vaginal tunic; frequently it occurs after bruises of the testicle in riding, and the like; sometimes from cold; after inflammation or other affections of the *urethra;* from wearing ill-fitting trusses, and from *syphilis.*

According to ROCHOUX (*a*), the swelling of the *scrotum*, consequent on a clap, does not, as generally supposed, depend on inflammation of the testicle, but on a hydrocele arising from inflammation of the vaginal tunic (a *vaginalité*, as he calls it.) The grounds of this opinion are, that the testicle, surrounded by a firm, thick, fibrous membrane, cannot swell up to such a degree in a few days, and sometimes even in a few hours, to double its natural size, and even more; that such swelling of the testicle rarely goes on to suppuration, whilst inflammation of that organ from other causes, commonly has that result; that at the onset there is always fluctutation with this swelling, and that, in some cases, fluctuation is perceptible on examination. GAUSSEIL (*b*) holds that

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(*a*) Archives générales de Médecine, vol. ii. p. 51. 1833.
(*b*) Archives générales de Médecine, vol. xxvii. p. 188.

a turbid, thick, somewhat sanguinolent fluid, corresponding to the size of the swelling, and a thick glutinous matter are found. And Rochoux (*a*) has shown from the examination of six bodies that it depends almost exclusively on fluid in the vaginal tunic. He believes, that if, in the after-course of the disease, fluctuation be no longer perceptible, it depends on the sensitiveness of the part, which will not bear a close examination and that, when dispersion begins by the absorption of the thin fluid, the swelling takes on the same character as if depending on swelling of a solid organ.

Velpeau (*b*) considers that there may be an outpouring into the vaginal tunic, but that this is slight, and does not constitute the disease, that the pain of an inflamed testicle is greater than when depending merely on fluid, that no transparency can be observed, and that the examination of the swelling with the fingers shows the *epididymis* participating in the disease. Blandin (*c*) holds that the state of the parts differs according to the period at which they are examined; that at first the inflammation descends from the *vasa deferentia* to the *epididymes* and the testicles, and a swelling of these arises, but that afterwards, and when the dispersion begins, the effusion is a principal symptom of the disease. Pigné (*d*) remarks, in opposition to these statements, that in young persons affected with this disease, whose hydroceles have been operated on with setons, in spite of the escape of fluid from both openings, a hard, irregular, painful tumour, of the size of a turkey's egg, is produced, which can only depend on swelling of the testicle. To this I would add, that after the operation by *incision*, the hydrocele, sometimes from the swelling of the testicle itself, most decidedly acquires the size of the swelling previous to the operation.

1938. The *prognosis* of hydrocele is favourable, and proper treatment effects a cure, if it be simple and without complication; but if there be a hardened testicle, the cure is only possible when the testicle can be brought back to its natural condition, or is removed. If the hydrocele be left to itself, nature alone cannot effect the cure, which however is not infrequent in children.

1939. The *cure* of hydrocele is palliative or radical. The former consists in drawing off the water by a puncture with a trocar or lancet; it is required in all those cases, where the radical cure is not proper, in very old persons, when there is also hardening of the testicle, and when the patient will not submit to its extirpation; if there be intestinal rupture, connected with the hydrocele-sac, or with the testicle, in very large collections of water, and in those cases where the condition of the testicle cannot be previously ascertained. The trocar is, in general, to be preferred to the lancet, for emptying the hydrocele, because the fluid will pass by the canula, and not escape into the cellular tissue of the *scrotum*. The lancet may be used when there is but little water, and accompanying intestinal rupture, or hardening of the testicle, because with it all possible injury may be easily avoided.

[Spontaneous cure of hydrocele sometimes, though very rarely, takes place. Brodie relates a case of this kind, in which the patient not liking to submit to the operation, the swelling grew so large, that he was obliged to resort to the "old clerical cassock to conceal his infirmity. When, however, he had had the disease for some years, the tumour began to disappear, and ultimately went away entirely, so that he was never troubled with it afterwards." (p. 90.) Astley Cooper mentions another mode of spontaneous cure:—"If an hydrocele be suffered to remain and become of large size; if the patient be under the necessity of labour to obtain subsistence, inflammation of the *tunica vaginalis* and *scrotum* will arise from excessive distension. A slough of the *scrotum* and *tunica vaginalis* is produced, and as it separates, the water escapes: a suppurative inflammation succeeds, granulations arise, and the patient in this way receives his cure." (pp. 95, 6.) It seems to me that this is precisely what would have happened in the second case of spontaneous cure related by Brodie; had he not checked the mischief by tapping the hydrocele, and drawing off "some ounces of fluid not like that of hydrocele, but a turbid serum, such as you find effused from inflammation." (p. 90.) Hydroceles are sometimes burst by a blow, but, according to both Cooper and Brodie, the disease

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(*a*) Acad. de Médec., Séance du Sept. 27, 1836.

(*b*) Above cited.

(*c*) Gazette Médicale, vol. iv. p. 638. 1836.

(*d*) French Translation of this Work.

is not thereby cured, but after a time reappears, the rent in the tunic having probably healed up.]

1940. The situation of the testicle must be ascertained before *puncturing* the hydrocele: it usually lies at the upper and hinder part of the swelling, and the best place for the puncture is the fore and under part. The testicle, however, may be situated elsewhere, it may be connected with the front of the vaginal tunic, in which case, a puncture at another part is most proper. The puncture is always to be made in the middle line of the swelling, because, in old hydroceles especially, the several vessels of the cord are often driven out of their place. According to RICHTER (*a*), the swelling is sometimes oblique, or even completely transverse, so that in hydrocele of the left side, the puncture must be made on the right side of the *scrotum*. In large hydroceles, a narrower part of the swelling sometimes extends upwards, even as high as the abdominal ring. Under these circumstances, a part of the *canalis tunicæ vaginalis* is distended, and by the puncture of the larger swelling, the water escapes from this *diverticulum*. In children, in whom the puncture is rarely necessary, the testicle generally is lower than in adults, the puncture must therefore be made rather higher than usual. The enlarged blood-vessels of the *scrotum* must be avoided in making the puncture.

1941. The patient must be placed on a seat, so that the *scrotum* may hang down loose. The Surgeon grasps the swelling at its hind part, and tightens the skin, whilst an assistant places his hand at the upper part of the swelling, and presses the water down. The operator holds a thin trocar in his right hand, and puts the forefinger of the same hand on its canula, to within half or three-quarters of an inch from its point, and then thrusts the trocar in rather obliquely upwards at the place determined. When it is ascertained, by the resistance ceasing, that the trocar has penetrated the cavity, the point of the trocar is to be withdrawn, and the canula thrust in deeper into the vaginal tunic. The trocar having been withdrawn, the canula is to be held steadily, so that it do not escape from the vaginal tunic whilst the water passes off. If there be a large collection of fluid, its flow must be often checked by placing the finger on the aperture of the canula, so that the testicle should not be too quickly relieved from pressure. When the emptying is completed, the canula is to be gently withdrawn, whilst the edges of the wound are held together with the finger and thumb of the other hand; and afterwards is to be closed with sticking plaster, and the parts supported in a bag truss.

The elder TRAVERS (*b*) has endeavoured to effect the radical cure of hydrocele with simple punctures. The *scrotum* is made tense with one hand, the patient being so placed that the light may pass through the swelling, to avoid the veins, or any thickened and adhering part. The punctures are to be made with an acupuncture needle, or what is still better, with a fine trocar, at equal distances, very quickly after each other, so that the tension of the *scrotum* may be kept up. The principal point in the operation TRAVERS holds to be the trifling discharge of fluid, and the escape of the remainder into the *m. cremaster* and cellular tissue. On the third, or even on the second day sometimes, the fluid is absorbed, and only when, on account of the smallness of the punctures, but a few drops escape, is the cure delayed beyond a month, or even it does not succeed; but in a large number, the cure is effected.

LEWIS (*c*) considers a single puncture more efficacious and less dangerous. I have never witnessed a cure by these means in very many cases.

[I have employed this treatment several times, and like CHELIUS, have not found it

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(*a*) Anfangsgründe der Wundarzneik., vol. vi. p. 59.

(*b*) London Medical Gazette, vol. xix. p. 737.

(*c*) Lancet, 1835-36, vol. ii. p. 206.

successful. The rapidity with which the absorption of the water emptied into the cellular tissue of the *scrotum* generally takes place is very remarkable; but the punctures in the vaginal tunic soon heal, and the water quickly re-collects, under which circumstances, I have several times had occasion to perform the cure by injection. The danger from this treatment, which LEWIS dreads, seems to me quite chimerical.—J. F. S.]

1942. If a lancet be used, it must, after the *scrotum* has been made tense, as already directed, be introduced with its edges above and below, at the appointed place, and the opening enlarged as it is withdrawn. Whilst the water flows, the skin must be kept sufficiently tight, so that the membranes shall not fall together, and prevent its escape; but if this happen, a probe must be passed in, and the flow restored. If the hydrocele be accompanied with intestinal rupture, it is most advisable to make a cut an inch long at the bottom of the swelling, to lift up the vaginal tunic with the forceps, and divide it with a bistoury held flat.

1943. If after the puncture the fluid will not pass out, on account of its consistence, or because it is contained in various chambers, either the radical cure by incision must be at once performed or the opening closed with sticking plaster, and the radical cure afterwards undertaken.

I have always found the fluid thin, and not contained in different sacs, when the testicle has not been otherwise diseased. But I have not unfrequently found, on the outer surface of the vaginal tunic, a pretty considerable quantity of consistent, gelatinous fluid, collected in the cellular tissue; whilst the fluid in the tunic was of its usual character. Sometimes bodies of various size, externally cartilaginous, but bony within, are found swimming in the fluid. They arise, as I have often noticed in the operation for hydrocele and in dead bodies, from the surface of the testicle and *epididymis*, overspread the vaginal tunic, are always strung together at their place of attachment, and at last get loose; or are enclosed in a cyst between the vaginal tunic, and the *tunica albuginea*, from which, when it is opened, these little bodies escape.

1944. The puncture generally soon closes; if inflammation occur, cold applications and leeches are requisite; and if it cause effusion into the cellular tissue of the *scrotum*, a cut must be made into it. If suppuration occur, it must also be quickly opened.

The emptying of the hydrocele most commonly effects only transient relief, and the fluid re-collects more or less quickly. In rare cases is it followed by a radical cure. If the swelling speedily acquire considerable size after the discharge, blood has been poured out into the vaginal tunic, which must be cut into; and if the spermatic artery be wounded, it must be tied.

[Simply puncturing a hydrocele but rarely cures the disease; "but to give the patient the best prospect of it," ASTLEY COOPER recommends "a strong stimulating lotion to be immediately applied." And he continues:—"Exercise sometimes produces inflammation;" and instances a person who had a cure after the inflammation set up by travelling all night, after the hydrocele having been tapped the previous morning (p. 98); this, however, was a lucky chance, and should not induce another person to try a like foolish trick; for, in another case, he relates directly after, an elderly gentleman, who had been tapped for hydrocele, died, in consequence of the inflammation excited merely by a long walk on the same evening. (p. 99.)

In old people, simple tapping is the only operation for hydrocele which ought to be performed; the others are very dangerous, on account of the inflammation which may ensue, and being without power, may run on to *gangrene*.—J. F. S.]

1945. The *radical cure* of hydrocele may be managed in two ways; either by increasing the activity of the absorbents, by diminishing the exhalation, and producing contraction of the vaginal tunic, whilst its cavity is preserved, or by exciting such a degree of inflammation as will produce a growing together of the vaginal tunic with the testicle.

1946. The *first kind of radical cure* may be effected by the use of solutions of hydrochlorate of ammonia dissolved in vinegar and spirits of wine, by fumigation with cinnabar, with sugar, with vinegar, by emetics and purgatives, and by repeated blisters and the like applied to the swelling. In adults these remedies are seldom of use, but in children they almost always disperse the hydrocele. Perhaps in grown persons they would be more effectual, if the water had been first drawn off. Kinder Wood (*a*) found that when the swelling had been opened with a broad lancet, and the water discharged, if a little piece of the vaginal tunic were drawn out with a hook, and cut off with scissors, and simply dressed, only a slight degree of inflammation ensued, which restored the exhalents and absorbents to their natural condition and caused a cure without the vaginal tunic growing to the testicle. When this tunic is thickened, such treatment is inapplicable.

1947. The *second kind of radical cure* of hydrocele is effected, *first* by incision; *second*, by injection; *third*, by seton; *fourth*, by caustic; *fifth*, by the tent; and *sixth*, by cutting away the vaginal tunic.

1948. In the *operation by incision*, the patient is placed upon a firm table; an assistant grasps the back of the swelling, and tightens the skin. The operator cuts freely through the skin, or through a fold of it, in the mesial line, and to the extent of two-thirds of the swelling (1); if the scrotal artery bleed, it must be tied. The operator then placing the fore-finger of his left hand on the middle of the swelling, thrusts a bistoury with its back upon the volar surface, into the vaginal tunic, and carries the finger in with it, so that when the knife is withdrawn, the finger may completely fill up the hole. The blunt-ended blade of a pair of scissors is now passed on the finger, and the opening in the tunic enlarged upwards and downwards, care being taken that the testicle do not protrude, and if it should, it must be gently returned. An assistant, with his fingers crooked, seizes the tunic at each angle of the wound, and lifts it up, so that its inner surface is laid open. A thin fold of linen dipped in fresh oil is then laid in the cavity of the tunic between it and the testicle, so that its edge projects in a ring around the cut. The cavity thus formed by the linen is to be filled with lint dipped in oil, and the edges of the wound having been brought together with sticking plaster, the whole is covered with a compress, and put into a suspendor.

(1) To render the cure satisfactory and perhaps, indeed, that it may be most complete, the cut should not exceed a third, or at the most, half the length of the swelling, as is proved by Ficker's (*b*) and Schreger's (*c*) practice, as well as by my own.

1949. The *after-treatment* is to be guided by the degree of the ensuing inflammation. If not very severe, it must be borne; but in the other case, it must be allayed by taking out some of the lint, by warm poultices and antiphlogistic remedies. On the third or fourth day, the dressings are to be changed, but the linen is not to be removed till it is quite sodden with pus. The space between the testicle and vaginal tunic is to be constantly filled with lint, and as it diminishes less lint should be introduced. When the suppuration takes place, collection and burrowing of the pus

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(*a*) Medic.-Chir. Trans., vol. ix. p. 38. 1818.

(*b*) Aufsätze und Beobachtungen, vol. i. p. 244.

(*c*) Chirurgische Versuche, vol. i. p. 125.

must be prevented. After-bleeding requires that the vessels should be tied, or cold water applied.

1950. If in the operation by incision, the testicle be found hardened, its extirpation must be at once performed. Hydatids on the surface of the testicle, or in the cellular tissue of the *scrotum*, must be seized with forceps, and cut off with COOPER's scissors.

1951. In the *operation by injection*, the puncture must be first made with the trocar, as already directed, and the testicle examined, to ascertain if it be hardened. One part of red wine diluted with two of water, and moderately warmed, is now to be injected through the canula of the trocar into the vaginal tunic with a syringe, fitting into the canula, till the tunic be completely or almost distended to its previous size. The fluid is generally kept in about five minutes with the finger upon the opening of the canula. The sensitiveness of the patient is to determine the strength of the injection and the length of time it should be retained in the tunic. In irritable persons, or if pain arise after the injection, it must be kept in only half the time. In not sensitive persons, when the hydrocele is old and the tunic thickened, pure wine must sometimes be injected, retained for a longer time, and several times repeated, to produce a sufficient degree of inflammation. In repeating the injection, it must be carefully observed that the canula has not escaped from the tunic. If by moving the outer end of the canula from side to side, its inner end move freely, the injection may be made, but if this be not the case, it must first be put right. When the injection has produced the desired effect, it must be carefully drawn off or pumped out with the syringe, so that none remain. The greatest care must be taken, when, after the instrument has been thrust in, and the stilette of the trocar withdrawn, that the canula be sufficiently deep in the tunic, there kept undisturbed, and the skin of the *scrotum* and vaginal tunic be firmly nipped with the fingers round the canula, or otherwise the tunic will easily slip off, and the injection be made into the cellular tissue of the *scrotum*.

1952. After the operation, the puncture is to be covered with sticking plaster, and the *scrotum* supported with a bag truss. In general, on the next day, redness, pain, and swelling come on; lukewarm applications are to be then made, or if the inflammation be not very violent, it may be left alone entirely; but if it be great, antiphlogistic remedies must be employed.

1953. In persons peculiarly sensitive, the mildest injection may be sufficient; thus the injection of the water just drawn off, or blowing air through the canula of the trocar to redistend the *scrotum*. The air may be left in twelve minutes, then let out, and the skin of the *scrotum* rubbed against the opening. After some minutes the injection of air must be repeated. A bougie should be left in the little wound, so that, if sufficient inflammation be not excited, the inflation may be repeated (*a*).

Various fluids have been employed as injections in the operation for hydrocele. CELSUS used a solution of saltpetre; LEMBERT, lime water, with corrosive sublimate; EARLE, port wine, with infusion of roses; JUNCKER, Medoc wine, with water; LEVRET, a solution of lunar caustic, or of zulphate of zinc; BOYER, red wine alone, or mixed with a little alcohol, or boiled with roses; DUPUYTREN, Rousillon wine boiled with roses and a little spirit of camphor; VELPEAU (*b*) has, after numerous successful cases, recommended injections of iodine, one or two drams of the tincture of iodine to an

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(*a*) SCHREGER, Ueber Heilung der Hydrocele durch Lufteinblasen; in his Chirurgische Versuch., vol. i. p. 132. Nürnberg, 1811.

(*b*) Hydrocèles de la Tunique Vaginale; in his Leçons Orales, vol. i. p. 262. 1840.

ounce of water; the patient suffers little by this plan, and next day can stand without pain, and go about. VELPEAU's successful treatment has been confirmed by others. In eleven hundred and forty-eight cases (*a*) treated with iodine injections, only three cases failed. In ten, injections with port wine failed. Injections of iodine succeeded in nine cases where previous use of port wine and sulphate of zinc had failed (*b*).

[The injection of tincture of iodine diluted with water, I am convinced, by repeatedly practising it for some years, is the most effectual and least painful to the patient. VELPEAU has the credit of introducing the practice, but I am informed by medical friends who have been in India, it has long been practised there, and, if my recollection be not treacherous, without drawing the injection off again. And this mode I have adopted, making use of a very fine trocar and canula, drawing off the water, and injecting an ounce of fluid containing two drams of tincture of iodine and six drams of water, and then immediately withdrawing the canula, to which the wound always clings very tightly, as the solution is very astringent. The patient most commonly suffers no pain, or at least a very trifling degree; and though on the following day the *scrotum* is a little reddened and rather firm, yet the patient is not thereby prevented moving about with ease and comfort to himself. Indeed, I am informed that as soon as the injection is made the person walks away, and requires no further attention. The *scrotum*, according to my own observation, increases a little, and becomes rather more solid for three or four days, and then begins to subside, and in the course of a fortnight the cure is completed without confining the patient more than two or three days, rather as precautionary, than that I believe it really necessary. I have employed this treatment in both large and small hydroceles, merely injecting the quantity mentioned or a little less; and never either shaking the *scrotum* about or distending the cyst by repeated injections, and afterwards drawing it off, as VELPEAU practises and recommends. I am quite sure that whoever once employs the iodine injection as I have mentioned, will not treat a hydrocele for the radical cure by any other means.

Hydrocele is sometimes not even at first cured by injection; and this ASTLEY COOPER seems to think depends on the after-treatment; "for," he says, "I sometimes fail, and should very often but for great care in the after-treatment, upon which, I think, much depends. I sometimes, when water is reproduced a few days after the operation, tap it to remove the serum, and to produce, by this operation, a larger share of inflammation." (p. 106.)

But occasionally the injection cures for a time, and then the disease reappears. BRODIE mentions two remarkable instances of this kind, one of which occurred to a patient of EVERARD HOME's, in which the disease recurred after seventeen years; and another, which happened under his own care, in which the disease returned after twenty years, the operation by injection having been performed in both cases by HOME.

Sometimes the inflammation set up by injection is so great as to terminate in suppuration; when this happens, and the existence of pus is decidedly shown, a free cut into the vaginal tunic should be made, so that the pus may readily flow out; after which all the symptoms of constitutional excitement soon cease. If by accident the injection should be thrown into the cellular tissue of the *scrotum* instead of into the cavity of the hydrocele, no time must be lost, but a free cut made through the skin, so that it may readily escape from the loose cellular tissue, otherwise there will be sloughing, and it may be the patient will lose his life, which has happened.—J. F. S.]

1954. For the *introduction of a seton*, after the puncture as already directed has been made with the trocar and canula, and the former withdrawn, a long tube is passed deeply through the canula, till it reach the fore and upper part of the *scrotum*. A long and pointed straight sound, with an eye at its other end armed with several threads, is then thrust through the tube outwards, carrying with it the threads, and then the canula is withdrawn. The ends of the seton-threads are tied loosely together, the wounds covered with sticking plaster, and a bag truss put on. About the tenth or fourteenth day, some of the threads are withdrawn at each dressing, and this is continued till all be taken out.

J. HOLBROOK (*c*) lets the water escape as usual, then takes up a fold of the skin

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(*a*) FRORIEP's N. Notizen, vol. viii. 1836, Nov.

(*b*) OPPENHEIM; in Hamburg. Zeitschr., vol. viii. pt. iv. 1828.—FRICKE; in same.

(*c*) Observations on Hydrocele, etc. London, 1825.

of the *scrotum* and of the vaginal tunic, and passes with a common needle a single or double thread from above downwards, which he removes on the third day.

ONSENOORT (*a*), with a needle curved and having a handle, passes a ligature through the middle third of the swelling from above downwards, or from below upwards. After the fluid has completely escaped, the thread is tied tightly. Two days after, the ligature is tightened, and after the cutting through is completed, on about the fourth or fifth day, the wound remains open from the bottom till the cure is perfected. In very large hydroceles he thrusts the needle into the middle of the swelling, carries its point upwards out through the skin, leaves one end of the thread loose, carries the point of the needle back into the cavity of the vaginal tunic, thrusts it through the skin below, and brings the other end of the thread out, and as he draws the needle out leaves the thread double in the middle wound, and cutting it through there, forms two ligatures, each of which he ties.

[My friend GREEN, from having observed the difficulty of regulating the inflammation, in treating hydrocele by injection, the impossibility of determining, at the time of the operation, what the effect will be in respect to the quantity of inflammation, and the dangerous results from the injection having been thrown into the cellular tissue of the *scrotum*, instead of into the vaginal tunic, was led to employ the seton (*b*), but differently from either of the above-mentioned modes. He thought, "if a seton were carried through the *tunica vaginalis*, there would be a source of irritation sufficient to produce the required inflammation, and at the same time the opportunity given of regulating its degree, that is, that the seton might be allowed to remain till there were symptoms of such a degree of inflammation as is requisite for the change necessary to be produced in the tunic, and that this being effected, the seton might be withdrawn; and that the extraneous irritant being thus removed, it would have no farther effect than was necessary, either for the change of the surface of the membrane, or for the obliteration of the tunic. (pp. 73, 74.) The requisite degree of inflammation is one which is attended with the ordinary symptoms of that process, that is to say, pain, heat, swelling, some redness, and some constitutional affection. There should be, I think, some affection of the pulse, some indication of febrile action in the system, before the seton is withdrawn. As soon as this has been observed the threads may be removed, and I believe that you may then expect you have excited inflammation enough to cure the disease. So that it is not whether the seton has remained in ten, twelve, or twenty hours, for this must be regulated by circumstances, but whether then the requisite degree of inflammation is produced. I should say that twenty hours was about the average time for the seton to remain; but it will vary in different instances." (p. 76.) GREEN's method consists in drawing off the water, as usual, with a trocar and canula, and when the hydrocele is emptied, the "canula still remaining in, to pass a needle six inches in length, and as thick as a probe, with a trocar point at one, and an eye at the other end, armed with twelve threads of ordinary seton silk, into the canula, and having carried it upwards to perforate the *tunica vaginalis* and integuments, near the upper and fore part of the swelling, and draw it out at that aperture. The canula is then removed, and the ends of the threads loosely tied together over a space of about two inches," (p. 59,) and these allowed to remain in till the inflammatory symptoms above mentioned make their appearance.

I formerly employed this practice a good many times, but one great objection seems to me the close watching it requires for some hours, and the difficulty there always is in determining the precise time when the seton threads should be withdrawn; and that often, even with the greatest care, either very severe inflammation would occur, or when enough only was supposed present to effect the cure, that it suddenly subsided, and a second operation was requisite. After using the iodine injection, I never recurred to this plan of treatment, although it was grounded upon better reasons than either of the other modes of using setons seem to have originated in.—J. F. S.]

1955. The *use of a tent* consists in the introduction, after puncturing the swelling, of a tent of lint, or a piece of bougie, through the opening into the cavity of the vaginal tunic.

1956. *Caustic*, consisting of a paste made with nitrate of silver and water, is applied in the usual way upon the front of the swelling, and allowed to remain for six or eight hours. When the slough has fallen off,

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(*a*) Heilung der Hydrocele durch die Ligature; in GRAEFE und WALTHER's Journal, vol. xiii. p. 628. 1828.

(*b*) St. Thomas's Hospital Reports.

the cauterized part is to be punctured with a lancet, and covered, after the emptying of the swelling is complete, with wadding.

According to Hesselbach (*a*), a plaster full of holes, and spread with powdered nitrate of silver, as thick as a knife, should be applied on the front of the swelling, over which a wad of linen and some sticking plaster should be placed, and the whole fastened with a compress and a bag truss. After eight hours the caustic and the plaster are to be taken off, the *scrotum* cleansed with water, and some lint spread with digestive ointment, applied to the slough. When this falls off, the vaginal tunic is laid bare, and being raised, by the pressure of the swelling, like a ball, this rounded part is then cut with the scissors, and the water emptied. The wound is to be cleansed daily with water, or with camomile tea, and bound up with lint. At every dressing, pieces of the tunic separate until the whole has come away. The wound daily diminishes, the suppuration ceases, and the wound closes.

1957. In *cutting away the vaginal tunic*, the skin of the *scrotum*, and the vaginal tunic are divided, the latter drawn out of the wound with the fingers, and cut off throughout its whole extent by a cut lengthways. The dressing and after-treatment are the same as in the operation by incision.

Boyer (*b*) recommends cutting through the skin the whole length of the swelling, for the purpose of isolating the vaginal tunic as far as possible opposite the testicle, then to open it, and cut off the flaps. Dupuytren considers it more simple to grasp the swelling. at the upper and back part, with one hand, so as to tighten the skin as much as possible in front, then to cut into the skin, to shell the vaginal tunic out, by pressing from behind forwards, and then to open and cut it off. Textor (*c*) endeavoured to unite the wound by quick union, as Douglas had previously done. Balling (*d*) strongly recommends excision; the part to be cut off should be some inches, of a semicircular form. After the operation, moderately cold applications should be employed till a layer of lymph appear on the wound, and the union is to be effected with sticking plaster.

[I apprehend no one would, in the present day, employ either of the latter two very painful and uncalled for modes of practice, which are now mere matters of history.—J. F. S.]

1958. The preference and rejection of the several methods above described must be decided on the following grounds. It is not advisable to produce upon the testicle any irritation like that on the vaginal tunic. By incision, all the complications can be most distinctly made out, at the same time any existing intestinal rupture can be properly treated, the inflammation be more properly excited, and effect a more safe cure. The bleeding which occurs in this operation is easily stanched; the severe symptoms occurring after it are most commonly the result of bad practice. After the cut, it is in most cases necessary to insert a half unravelled piece of linen between the wounded edges of the vaginal tunic. Injections operate uncertainly, as the irritability of the individual cannot be previously determined; they act as violently on the testicle as on the *scrotum;* if a part of the injection be poured into the cellular tissue, which is possible, even with the greatest care and attention, very dangerous symptoms may arise therefrom; in a diseased state of the testicle, which cannot always be decidedly made out, injections are necessarily hurtful. The superiority of injections, to wit, that by their use the cure follows more quickly, and that the patient does not need to be kept so long quiet, is of no value, as even after injection the cure is often longer protracted than by incision, and with the latter keeping so long quiet is not necessary. The same observations apply also to the cure by seton and by tent, except that

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(*a*) Jahrbücher der philosophisch-medicinischen Gesellschaft zu Würzberg, vol. i.

(*b*) Maladies Chirurgicales, vol. x. p. 209.

(*c*) Ueber eine neue Art die Hydrocele zu heilen; in N. Chiron., vol. i. p. 416.

(*d*) Heidelb. klin. Annal., vol. vii. p. 130.

with them the cure is still less sure. Caustic also acts uncertainly; its operation is slow and painful: incision is therefore to be considered the most sure. Extirpation is to be confined to those cases only where the vaginal tunic is highly disorganized or bony (*a*).

[I have thought it more convenient to notice the advantages and disadvantages of the several modes of treating hydrocele, when describing each method. To these, therefore, the reader is referred back.—J. F. S.]

1959. *Congenital hydrocele* (*Hydrocele congenita*) consists in a collection of water in the canal of the vaginal tunic, which remains open either throughout its whole length, or only at certain parts, in consequence ot which several kinds of hydrocele are formed: *first*, the canal is open throughout its whole length, and filled with water; *second*, the canal is closed above the testicle, and remains open only at the upper part; *third*, the upper part closes and the water is contained in the lower part, and in the vaginal tunic of the testicle; *fourth*, the canal is obliterated above and below, and there remains only a bladder-like cavity at one part, which contains water.

1960. If the whole vaginal process of the *peritonæum* remain open from its orifice in the belly to its bottom, and the water collect in it, a long roundish swelling appears, which reaches from the abdominal ring to the testicle. The testicle is either little, or not at all felt, because it is completely surrounded with water; but, on the contrary, the spermatic cord is distinctly felt along the hind surface of the swelling, though rather more outwards. The possibility of pushing back the fluid, and its return by the abdominal aperture of the vaginal process causes the diminished size or total disappearance of the swelling, in the horizontal posture, or by pressure, and its increase in the upright posture, by exertion, coughing, and the like. This subsidence and reappearance of the swelling does not take place with equal readiness in all cases: if, for instance, the upper part of the vaginal canal be somewhat narrowed, a longer continued pressure upon the swelling from below upwards is necessary, in order to force the water back; or it must also be raised somewhat inwards, so as to bring the vaginal process in a right line with the inguinal canal: the water retires slowly, and only slowly returns.

The natural cure is in these cases not rare. If the disease continue beyond the first month, it becomes larger; sometimes it attains quickly, sometimes slowly, a considerable size. The end of the first twelvemonth, the third and seventh year, and the period of puberty, have considerable influence on the development and subsidence of this kind of hydrocele.

Closely resembling hydrocele of the vaginal process in man, is the *congenital hydrocele of women*, in which, by the collection of water in the peritoneal sheath of the round ligament, a swelling is formed, which passes through the inguinal canal into the lower part of the *labium pudendi*, and is at first returnable, but afterwards not so (*b*).

1961. This hydrocele may have already formed in the *fœtus*, and afterwards become further developed; but it may first arise after birth, as the vaginal canal often remains open for some time. The circumstance of the vaginal process often remaining a long while open, and no water being collected in it, proves that the water does not merely flow from the belly into the vaginal process, but that its collection depends on undue propor-

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(*a*) Textor, above cited.—Klein; in Heidelb. klinisch. Annal., vol. ii. p. 109.—Spangenberg; in Graefe und Walther's Journ., vol. ix. p. 1.

(*b*) Sacchi; in Annali Universali de Medicina, vol. lvii. p. 437. 1831.

tion between absorption and secretion on the inner surface of the vaginal canal. This disease is frequent, but in many cases is not observed, partially on account of its slight degree, and the child's constantly lying on his back, and in part because it subsides of itself. It is not unfrequently accompanied with protrusion of the intestine or *omentum*.

1962. The *cure* depends on getting rid of the water, and closing the vaginal process by the adhesion of its walls. VIGUERIN endeavours to effect it by pressing back the water into the belly, and closing the abdominal ring with a truss. DESAULT, after returning any existing rupture, and carefully closing the abdominal ring by pressure, punctured the swelling, emptied the water, and injected red wine, which after a little time he withdrew, and wrapped the whole *scrotum* with compresses steeped in red wine, and applied a truss (*a*).

1963. Although the treatment of congenital hydrocele, with injections, has, in many instances, been successful, it cannot, however, be denied, that it always has a very serious effect on little children, and that dangerous inflammation may ensue. VIGUERIN's practice is, therefore, always preferable, and may, perhaps, cause a more certain cure, if the pressure be sufficiently strongly made on the upper part of the vaginal process, and a suspender, moistened with spirits of wine, vinegar, and muriate of ammonia, or any other astringent fluid, be at the same time worn.

1964. If the vaginal process be adherent merely above the testicle, and thence open into the cavity of the belly, a bladder-like swelling is formed by the collection of the water in this open part, which may extend even into the cavity through the abdominal ring. The water can be returned but slowly into the belly. The *treatment* is the same as in the previous case.

1965. If the abdominal mouth of the vaginal canal be closed to the pillars of the abdominal ring, and the other part remain open, the water collects in that part even to the bottom of the vaginal tunic. In this case the swelling terminates at the ring, and the water cannot be pressed back into the belly.

1966. If the vaginal canal be obliterated above and below, a cyst is formed in the part remaining open by the collection of water, which cyst is connected with the *peritonæum*, and extends from the abdominal ring to the testicle. After lying on the back the swelling is less tense; but it becomes more full and elastic after long standing. If compressed, it recedes a little, but quickly reappears. The spermatic cord may be felt below or behind the swelling.

1967. The *treatment* of these last two kinds of congenital hydrocele requires, in most cases, only the use of dispersing remedies, by which, in children almost always, their cure is effected. These are rubbing in mercurial ointment, or spirituous fluids; the steam of vinegar; fumigation with mastic, amber, or sugar; lotions of spirits of wine, red wine, the acetated liquor of ammonia, alum dissolved in water, with a little sulphuric acid; dispersing plasters, and the like. If not thus cured, the water must be emptied by puncture, and the radical cure by injection, or by blowing in air, resorted to. In cystic hydrocele, in children, the discharge of the water is best managed by puncture with the lancet; but

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(*a*) Œuvres Chirurgicales, vol. ii. p. 441.

in adults, the cyst should be laid bare with a cut, and removed with Cooper's scissors.

The following works may be consulted on Congenital Hydrocele :—

Schreger, Neue Darstellungen aus dem Gebiete der Hydrocele; in his Chirurgische Versuche, vol. i. p. 1.

Wall, C. A., De diversâ Hydroceles congenitæ naturâ. Berl., 1820.

1968. When a hydrocele is connected with a rupture, that is, when the sac of a congenital or accidental rupture has its usual contents of collected water and protruded intestine, the hydrocele in general rises up to the pre-existent rupture; the hydrocele is rarely first present, and the rupture subsequent. In most cases rupture, complicated with hydrocele, is always accompanied with adhesion, and the hydrocele is the unnatural secretion of the inner surface of the rupture-sac, in consequence of the inflammation which has caused the adhesion. This inflammation may arise from undue pressure of a truss, from catching cold, external violence, and the like. A collection of water soon forms in strangulated rupture.

1969. The symptoms vary according as the hydrocele connected with a rupture is larger or smaller. For example, *first*, if the protruded intestine be quite full, and close the upper part of the rupture-sac, and the water collect only in the lower space, as happens when an inguinal rupture is added to a pre-existing congenital hydrocele, or a hydrocele to a congenital rupture, or an omental or intestinal rupture adherent at the neck of the sac is complicated with hydrocele, then the form of the swelling is at first conical, with its base towards the abdominal ring; but, in proportion as the water collects, the upper part of the swelling becomes narrower. If the rupture or the hydrocele be congenital, the swelling extends to the bottom of the *scrotum*, then it is surrounded with water, and cannot at all or not satisfactorily be distinguished. On the contrary, if the swelling be confined to the testicle, it can be felt at the under hinder part. *Second.* If the protruded intestine completely enter the rupture-sac, and the water only spread over its surface and the interspaces, as in hydrocele accompanying ruptures which are movable, enlarge easily, are very old, or are attached to the bottom of the rupture-sac, then the swelling enlarges more in breadth than in length, and mostly assumes an oval form. *Third.* In a congenital rupture, when the upper part of the vaginal canal is narrow, and little extensible, the water may completely fill the whole bag, and merely a small portion of intestine or *omentum* protrude externally through the abdominal ring, and be surrounded with the water. *Fourth.* A small intestinal rupture, when accompanying a previously existing hydrocele, may remain in the canal between the internal and external abdominal rings, in which case the rupture is prevented by the stricture of the canal exceeding the bounds just mentioned.

1970. The *diagnosis* of these different forms of hydrocele, complicated with rupture, is, in many instances, accompanied with great difficulty. The following circumstances, however, lead to it. In the first case, the upper part of the swelling, when intestine is there, is firm, elastic, and hard, but doughy, with an omental rupture; the lower part, which contains the water, is yieldingly elastic, sometimes even fluctuating. With a reducible rupture, there remains, after its return, a fulness at the bottom of the sac which cannot be produced by a piece of intestine, because it is not attached to the abdominal ring, and when this is the case, the water can be driven backwards and forwards. In old and adherent ruptures the *diagnosis* may be more difficult, though it can be determined by a close examination, and the case may be distinguished from a growth of the protruded parts, or from an enlargement of the swelling by newly-projected parts. In the second case, examination does not present the simple elasticity of intestinal rupture, nor the regularly distended condition of hydrocele, as at the part where the intestine is, it is more rebounding, and the fluctuation scarcely at all decided, and only obscurely perceivable at some spots. In this and the previous case, there is this peculiarity, that in long-continued horizontal posture the bulk of the swelling lessens, as a part of the water, if the neck of the sac be not entirely closed, by the adherence of the rupture itself, returns into the belly; on the contrary, in long-continued standing, the swelling enlarges, by the re-descent of the water. In the third and fourth cases, the *diagnosis* may indeed be difficult; here, however, the history of the disease, as well as a certain fulness of the inguinal region, immediately above the external abdominal ring, directs the practitioner, as well as the circumstance, that if the rupture follow a pre-existing hydrocele, instead of the appearance of the fulness in the inguinal region, the water is returned with more difficulty into the cavity of the belly, and that it returns freely, when the rupture has entirely, or, for the most part, been reduced by the previous attempts at reduction acting on the region of the abdominal ring.

1971. The *treatment* of hydrocele accompanied with rupture, is especially directed in reference to the condition of the latter, whether it be *movable* or *adherent*.

1972. With a movable rupture, a cut an inch in length is first made through the skin, so as to return the intestine, the exposed rupture-sac is then lifted up with the forceps, and a slight opening made in it with the scissors for the purpose of introducing an injection-tube, through which, the abdominal ring being carefully closed, one of the above-mentioned injections (*par.* 1951) may be thrown in to excite adhesive inflammation, and with moderate compression, to produce union. After the reduction of the rupture, this may be effected by making a cut and introducing a tent. A truss must be worn till the complete adhesion of the sac has been effected, and even longer.

Desault (*a*) first emptied the water by a puncture with a trocar, then whilst the canula was remaining in, replaced the rupture, and injected red wine.

1973. When the rupture is adherent, and the adhesions are firm and considerable, the treatment, with an intestinal rupture, must be merely confined to palliation by puncturing with a lancet, after previously making a cut through the skin, or opening the exposed rupture-sac as in the operation for strangulated rupture, and by the use of a suspendor. Congenital omental rupture allows an earlier radical cure of hydrocele, as the *omentum* more readily assumes the process of adhesive inflammation. If, however, the union be slight, which may be determined by the possibility of reducing the greater part of the rupture, the sac must be carefully opened by a cut as in the operation for hydrocele, the adhesions divided, the taxis employed, and then by introducing a tent of lint a sufficient

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(*a*) Œuvres Chirurg., vol. ii. p. 441.

degree of inflammation excited for the purpose of furthering the adhesion of the rupture-sac (*a*).

[I do not think that under any circumstances a conjoined congenital hydrocele and rupture, or a congenital hydrocele followed by protrusion of intestine, should be meddled with in any way beyond the use of cold astringent washes and the application of a truss. Injections or the introduction of tents I should think exceedingly dangerous practice, and on no account to be resorted to.—J. F. S.]

1974. *Hydrocele of the general vaginal tunic (Hydrocele tunicæ vaginalis communis)* is either an œdematous swelling in the cellular tissue, which surrounds the spermatic cord, or the water collects in one or more cells of the spermatic cord, or is found in hydatids (*b*).

1975. In the first case, the swelling which is along the spermatic cord, at first produces no inconvenience, the *scrotum* is not altered, except that if it be not wrinkled, it drops lower on one side than the other. The testicle is felt in its natural state. The swelling is broader below than above, seems to diminish by gentle and pushing pressure, though it resumes its appearance when the pressure is removed, both when the patient lies down and stands up. If fluctuation be observed, it is only distinct at the bottom, because the water sinks down especially, tears some of the cells, and so forms a larger cavity; therefore, no considerable quantity of water can be drawn off when a puncture is made anywhere but at the bottom of the swelling. If the base of the tumour be pressed, the water quickly rises up towards the top, and distends it. And if the swelling be within the abdominal ring, it distends it also. When it acquires a certain size, the patient often feels pain and dragging in the loins. The disease may be accompanied with a varicose state of the spermatic cord, and with omental rupture. Its confusion with the latter of these is very easy, and the following may be remembered as distinguishing characters between them, that the hydrocele of the spermatic cord has less consistence, and has not so irregular surface as omental rupture; it is also usually broader towards its base, whilst the contrary is the case with omental rupture (*c*).

1976. So long as the swelling in infiltration of the spermatic cord is small, a suspendor should be worn: when the disease becomes inconvenient, the swelling must be opened with a cut, without wounding the cord, and lint put into the wound, which is to be cured by granulation.

1977. *Hydrocele in one or more cysts* (*Hydrocele cystica*) is mostly situated in the middle of the spermatic cord. The swelling it produces is very much distended, so that the fluctuation is not always distinguishable, circumscribed, painless, and transparent. It can never be diminished. If it lie near the abdominal ring, it can be often somewhat pushed into it. The testicle and cord are distinctly felt. If the swelling enlarge deeply towards the testicle, the latter is felt on its hind part. Children and young persons are more subject to this hydrocele than adults; it is very probable that in most cases this results from a partial opening of the vaginal canal, whilst it is obliterated above and below, and loses itself in the cellular tissue. (*par* 1966) (*d*).

1978. In children this swelling is often dispersed by the remedies already mentioned (*par.* 1967); in adults it is stubborn. If an operation

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(*a*) SCHREGER, Ueber Erkenntniss und Behandlung der mit Hernie complicirten Hydrocelen; above cited, p. 86.

(*b*) LARREY, Observation sur une Tumeur aqueuse des Bourses; in Mém. de Chirurg. Militaire, vol. iii. p. 419.

(*c*) SCARPA.

(*d*) SCARPA, above cited.—FRORIEP'S Chirurg. Kupfertaf., pl. cii. ciii.

be required, the cyst is to be laid bare by a simple cut through the skin opened, and so much of it removed as can be done without wounding the spermatic cord; some lint is to be put into the wound, the suppuration destroys the rest of the cyst, and the wound heals by granulation.

FOURTH SECTION.—FORMATION OF STONY CONCRETIONS IN THE FLUIDS OF THE BODY.

1979. In the various fluids of the body, especially in the urine, bile, spittle, and *fæces*, when they are retained, or when their properties are altered by individual constitution, disease, mode of life, influence of climate, or of food, in regard to their quality and quantity, *hard, stony concretions* may be formed by the union of the several constituents, or by the production of new substances. Sometimes there may be a foreign body around which the constituent parts of the fluids are deposited so as to incrust it. The phenomena which these concretions produce, are different according to their seat, their form, and their quantity. The treatment consists in their solution or removal.

At present merely the stony concretions in the urine are to be considered.

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1980. The deposits from the urine are either powdery or crystalline, *gravel*, or hard large concretion, *stones*, which are formed by the union of these sediments.

[For the accompanying notes on the chemical part of this subject marked T. T., I have to thank my friend Thomas Taylor.—J. F. S.]

1981. From the earliest times various opinions have been advanced as to the manner and way in which the formation of these concretions take place, which, however, has only been placed on a sure base by the progress of chemistry, and by the careful examination of these concretions, especially by Scheele, Wollaston, Fourcroy, Vauquelin, Brande, Marcet, Prout, Magendie, Fuchs, Liebig, Woehler, Willis, Taylor, and others. Passing over the old opinions, those theories only which have of late years been advanced in reference to the formation of stone will be here given.

Wurzer (*a*) has collected the most valuable notions of the old practitioners and naturalists on this subject. So also Martin (*b*.)

1982. Magendie, who treats specially of uric acid concretions imagines that the causes of gravel and stones of this kind depend *on an absolutely*

(*a*) Programma de Analysi chemica Calculi Renalis Equini. Marburg, 1813. (*b*) Above cited.

increased quantity of uric acid, on a diminished quantity of the urine with the like quantity of uric acid, and on the diminished temperature of the urine, in consequence of which the uric acid is deposited either in the form of gravel, or, being united by some connecting matter, forms the larger concretions. The quantity of uric acid is increased by the use of food abounding with azote, flesh meat, strong wine, liquors, want of exercise, and the like. The quantity of urine diminishes whilst the quantity of uric acid still remains the same, in violent sweating. And the temperature of the urine diminishes in advanced age, on which account gravel is then of common appearance. The above cases are also especially favourable to gout; and, therefore, between gout and stone there is a close alternation.

1983. VON WALTHER assumes, besides the *excessive production of uric acid*, a change in its quality, at least in reference to its degree of oxidation, and a more or less copious secretion of a connecting gluten. These three circumstances arise from a vital influence of the urinary organs on the fluids contained in them; and the activity inducing *lithogenesis*, consists, if not in an inflammation of the mucous membrane of these parts, (as believed by the English physician, W. AUSTIN,) at least in a state analagous to it. Hence originates a more copious production of the connecting substance which takes up the precipitated particles of the strongly oxidized uric acid, and thus gradually forms the nucleus of the stone. Without this connecting matter, *sand* and *gravel* alone are produced. The presence of this gluten, especially prevents the crystallization of the constituent parts of the stone and the ammoniaco-magnesian phosphate alone is most frequently crystallised in stones. *Lithogenesis* is to be considered as a medium between chemical crystallisation and organic growth, but it has always the greater disposition towards the latter.

Stones are characterised by their organic structure; and their process of formation is comparable to the origin of indurations, *scirrhus* and the like. VON WALTHER distinguishes between *urinary incrustations* of foreign bodies, in which the phosphoric acid salts of the urine are deposited in a similar way to that in which the dipping of a foreign body into a solution of salt produces its crystallization, whereby the outermost layer of most urinary stones consists of phosphates, and *urinary concretions*, the formation of which takes place as above described. In regard to the several kinds of stones, he considers the relative want of hydrogen in the urinary system, to be in all cases a necessary condition in the production of stone, both as regards the concretions of uric acid, and those which contain oxalate of lime. Excess of azote appears to determine the origin of the former as the want of it does that of the latter. Between the concretions of uric acid and the gout there is a relation similar to that between the phosphatic concretions and the imperfect development of the bony system.

1984. WETZLAR has endeavoured to controvert both these opinions. In opposition to MAGENDIE, he asserts that, although in many cases gravel depends on the absolutely or relatively increased quantity of the uric acid, the production of concretions of uric acid often occurs under circumstances which do not produce uric acid in excess; nor does any deposit take place when the urine contains very much urate of soda; for instance, in the critical urine of fever, where sediment does not form until after the urine has cooled. Against WALTHER's theory,

Wetzlar objects that stones, although existing in an organic fluid, are not to be considered as organic bodies; and that their structure and form have nothing which entitles them to be called so: that the assumption of a changed condition of the uric acid, and a peculiar affection of the urinary passages, is hypothetical; that an increased production of uric acid is by no means necessary for the formation of stone, as no precipitation of the uric acid is caused by it; that the natural quantity of uric acid is sufficient to yield material for concretion; and that the *free state of uric acid*, hitherto considered as a natural condition, is an unnatural one, and the proximate cause of stone. He is of opinion that the uric acid occurs in combination with soda, and when, instead of the weak lactic acid, which is the free acid of the urine (1), and may co-exist with the urate of soda, a stronger acid is secreted, which decomposes that salt, then the uric acid is precipitated; an opinion which **Prout** had already advanced, with regard to the occurrence of uric acid with ammonia, in the urine, and the precipitation of the former by the development of another free acid. Although **Magendie** has not admitted the transmission of acids into the urine, yet **Weltzlar** believes that an excess of acids in the juices may occur from acid drinks, sour wines, bad sour beer, unnatural acidity in the *primæ viæ*, especially in children; and that it may also occur from the relative want of another element, as hydrogen. The secretion of the urine in the kidneys is assumed to be from a process of oxidation and combustion; if this be more quick, active, and energetic, then, instead of the weak lactic acid, a stronger acid is secreted, which decomposes the urate of soda. Here the doctrine of **Austin** and **Walther**, of a sort of inflammatory irritation of the urinary organs, may, in some cases, be well founded, as an inflammatory condition of the kidneys is the excitant of a more powerful oxidating process for the secretion of urine, and is thus actually the cause of *lithogenesis*. The connecting medium, the animal gluten, is, according to **Wetzlar**, not necessary for the production of stone. This always goes on slowly, and it is easy to comprehend how as this precipitation slowly takes place, the first molecules of uric acid unite, attract animal matter, especially *mucus* from the neighbourhood of the fragment, and gradually increase. This, however, is no organic growth. That the materials of which stone is composed are nearly all uncrystallized in it, as **Von Walther** concludes, from its organic formation, is very natural, as even without the animal *mucus* which prevents crystallization, these constituents have little disposition thereto, even out of the body. In sand and gravel there is a deposit, because there is an excessive production of urate of soda. This salt is very quickly separated and discharged with the urine.

[(1) **Liebig** (*a*) denies altogether the existence of lactic acid, either in the urine, or in fresh milk. He attributes the acidity of healthy urine to the superphosphates of lime, magnesia, and soda.—T. T.]

1985. According to **Willis**, it is not necessary to seek anxiously after a chemical cause for the deposit of uric acid; it is sufficient to say, that in certain conditions of the constitution, under the influence of peculiar disturbance of the vitality of the kidneys, a very insoluble constituent is

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(*a*) Ueber die Constitution des Harnes der Menschen und fleischfressenden Thiere; in Annalen der Chemie und Pharmacie, vol. l. p. 161. 1844.

produced from these organs. He considers the production of uric acid, and urates, of oxalates, of cystic and xanthic oxides as very similar, and thinks that, according to the results of modern chemistry, by which a quantity of organic substances may, by a peculiar treatment, be converted into one another, the origin of these various concretions may be cleared up. *Urea*, of which the ultimate elements are 46,65 nitrogen, 19,97 carbon, 6,65 hydrogen, and 26,65 oxygen, ($N^4 C^4 H^4 O^2$,) is converted into uric acid, when the proportions of nitrogen and hydrogen are diminished, and the quantity of carbon and oxygen increased, 33,37 nitrogen, 36,00 carbon, 2,36 hydrogen, 28,27 oxygen ($N^4 C^5 H^4 O^3$.) If the proportions of nitrogen, carbon, and oxygen, remain as in uric acid, while the quantity of oxygen is diminished about one atom, uric oxide (xanthic oxide, according to MARCET) is produced ($N^4 C^5 H^4 O^2$.) If the quantities of nitrogen and carbon be diminished, whilst the quantities of hydrogen and oxygen are relatively increased, cystin (cystic oxide of WOLLASTON) is produced, 11,85 nitrogen, 29,88 carbon, 5,12 hydrogen, 53,15 oxygen ($N C^3 H^6 O^1$.) If, on the one hand, nitrogen and hydrogen combine, and on the other, carbon and hydrogen, in nearly the same proportions as the former exist in uric acid, and the latter in cystin, oxalic acid is produced, 33,99 carbon, 53,33 oxygen.

[(1) Sulphur forms an essential coustituent of cystic oxide; and THAULOW (*a*) ascertained that it contained about 25 *per cent.* of that element. The accuracy of this statement has been confirmed by the analyses of two stones in the Museum of the Royal College of Surgeons (*b*). According to THAULOW, cystic oxide consists of carbon, 30,01; hydrogen, 5,10; nitrogen, 11,00; oxygen, 28,38; sulphur, 25,51; and that it is represented by the formula $C^6 H^6 N.O.^4 \; S^2$.—T. T.]

1986. JONES assumes on LIEBIG's principles, that uric acid is produced from tissues which afford *albumen* and *gluten*, (*gelatine?*) in consequence of a change of matter, and the effect of oxygen. That the uric acid is converted by the influence of oxygen, into alloxan and *urea*; that, by a farther operation of the oxygen upon the alloxan the latter is either changed into oxalic acid and *urea*, or into oxaluric and parabanic acid, or into carbonic acid and *urea*; and that the quantity of uric acid which is separated, alternates in inverse proportion to the quantity, which is still further altered within the body, and with the amount of action of the oxygen. On these principles we may, perhaps, establish a general theory of the causes of *lithogenesis* as follows:—When the health is good, and the operation of the oxygen perfect, there is no deposit in the urine; if the oxygen act in a slighter degree, there is a deposit of oxalate of lime; if, in a still less degree, urate of ammonia, or uric acid, is formed. If the health be disturbed, or if the urine become alkaline, from the irritation which the stone produces, the phosphates are precipitated; and if the effect of the oxygen be still further restricted, only an exceedingly small quantity of phosphoric acid is produced, and carbonate of lime is precipitated.

1987. For the proper explanation of the origin of stone, it seems most convenient first to ascertain the origin of those substances *which alone are capable of forming the so-called nucleus of urinary stone, or of being precipitated as gravel*, as the deposit of various substances upon a stone

(*a*) Annalen der Pharmacie, vol. xxvii. p. 200. 1838.

(*b*) TAYLOR's Catalogue, above cited, part i. p. 137.

once formed is less difficult to understand and to explain. It must not, however, be overlooked that the altered condition of the kidneys, and of the urinary organs in general, has an important influence in the production of stone.

1988. The *general constituents of stones*, excepting the animal matter existing in different quantity as the connecting material, are:—

1. *Uric Acid.*
2. *Urate of Ammonia.*
3. *Phosphate of Lime.*
4. *Phosphate of Ammonia and Magnesia.*
5. *Oxalate of Lime.*
6. *Carbonate of Lime.*
7. *Silica* (1).
8. *Cystic Oxide.*
9. *Xanthic Oxide.*
10. *Iron* (1).

Of these substances the following occur in the nuclei of stones, or they may form their entire bulk:—

(a) *Uric Acid.*
(b) *Urate of Ammonia.*
(c) *Oxalate of Lime.*
(d) *Cystic Oxide.*
(e) *Xanthic Oxide.*
(f) *Phosphate of Ammonia and Magnesia.*

From these six substances, which form the *nucleus*, or the entire bulk of a stone, the various kinds of gravel are also produced.

Besides the ten above mentioned constituents, von Walther has also given *phosphate of ammonia and lime*, and the *acid phosphate of lime* (2). Both these substances appear to me doubtful. Not merely is the *phosphate of ammonia and lime* altogether new as an addition to the constituents of stone, but also new as a combination of phosphoric acid, for *phosphate of ammonia and lime*, is not admitted by any chemist. In respect to the *acid phosphate of lime*, von Walther supposes that it alone is capable of forming concretions, but that on the other hand, the neutral phosphate of lime only occurs in the layers. It is to be regretted that von Walther has not given the careful analysis of Fuchs on this subject; as it is difficult to understand how the acid phosphate of lime, which is so very soluble, that even in the air it softens into a molten glass-like mass, can form stones. It is important here also to observe that the acid phosphate of lime is not met with in gravel, in which, however, all the other substances are found which are capable of forming the nucleus of a stone. Walther's assertion that phosphate of lime occurs only in the layers, is contradicted by the observations of Wollaston (*a*), who examined urinary stones which consisted entirely of phosphate of lime. Their surface, he says, is pale brown, and as smooth as if polished; their interior consists of regular layers, which can easily be separated into concentric plates. These stones are, according to Marcet, very rare. Perhaps this contradiction may be reconciled by the fact that these are such stones as are formed in the prostate gland, (*prostatic stones* of Marcet,) which consist of a neutral phosphate of lime, coloured by the secretion of the prostate, by which, according to Marcet, these stones can be distinguished from true urinary stones. Or there may perhaps have been a nucleus which was overlooked. The *carbonate of lime* (first mentioned by Bergmann, since by Crampton, and most recently by von Walther) is found, according to the latter, in the outer substance of the stone with the phosphates, but not in the layers, and it appears to enter into no combination with the uric acid, the urate of ammonia, and the oxalate of lime. Goebel (*b*) describes a stone which consisted, he says, of carbonate of lime 96,025, and animal matter with silica 3,125. Silica is met with but rarely in urinary stones, and is always accompanied by uric acid or oxalate of lime. According to Berzelius, this earth exists in small quantity in the urine; he derives it from the water and the food. Marcet found in one stone a substance corresponding with the fibrin of the blood (*fibrin stone.*) Iron is found in combination with uric acid, with phosphate and carbonate of lime, and as iron ochre. Brugnatelli has found *benzoate of ammonia* in a stone, which he describes among the more rare, consisting of little *stones* connected together, of a grayish colour, with a smell like castor, light but hard, and containing also phosphate and oxalate of lime.

(*a*) Philosophical Transactions, vol. lxxxvii. p. 395. 1797.

(*b*) In Trommsdorff's Neue Journal de Pharmacie, vol. vi. p. 198.

[(1) Silica and iron cannot be said to be general constituents of stones, as they never form an entire stone, and they have only been detected in very minute quantities in some few instances.

(2) By acid phosphate of lime is meant, not the super-phosphate, but the neutral or di-phosphate of lime, the "*phosphate acidule de chaux*" of Fourcroy. Berzelius has commented upon the absurdity of the French chemist describing a solid concretion as composed of an acid phosphate of lime. His criticism, however, is only partially correct. The fact is, when the di-phosphate of lime *calculus* is digested with water, it is decomposed into an insoluble sub-phosphate, and a soluble super-phosphate, which of course possesses an acid reaction. It was from observing this latter fact that led Fourcroy into the error of describing these concretions as composed of a super-phosphate of lime. Di-phosphate of lime constitutes the occidental bezoar, an intestinal concretion found in the stomach, &c., of the deer of South America (*a*).

(3) " *Calculi*, from the human subject, composed entirely of carbonate of lime, are of extremely rare occurrence, and have been noticed only by a few authors. The existence of such concretions was first pointed out by Brugnatelli (*b*), who describes forty-eight small concretions, which were extracted from the bladder of a young man. They were each about the size of a pea, possessed a lamellar structure, and broke with a shining surface. The same author also mentions several ash-coloured *calculi* composed of carbonate of lime, with a trace of carbonate of iron, that were taken after death from the bladder of a woman. Dr. Prout (*c*) has also seen small *calculi* of this salt which were 'perfectly white and very friable.' A remarkable collection of these *calculi* is in the possession of R. Smith, of Bristol; * * * " five were extracted by the lateral operation from the bladder of a boy aged sixteen, by H. Sully, and the others, fifteen in number, were passed by the *urethra* of the same patient previous to the operation. The former are exceedingly irregular in figure, their external surface is rough, and is dusted over with a white powder. The largest of these *calculi* was about the size and figure of a large almond; when sawn through, it did not appear to consist of concentric layers, but exhibited irregular waved lines of various shades of brown, resembling very closely the section of a compact mulberry *calculus*. It was so extremely hard as to require a lapidary's wheel to divide it, and the cut surface readily acquired a fine polish. The *calculi* that were passed by the *urethra* are about the size of peas, of a rounded figure, with flattened surfaces. They present a compact lamellar structure, and their external surface is of a light brown colour" (*d*).—T. T.]

Uric Acid and Urate of Ammonia.

1989. According to the experiments of Prout and L. Gmelin, it is extremely probable that uric acid does not occur, as Wetzlar asserts, combined with soda; but in combination with ammonia. Also, that the acid property of the urine does not depend on free lactic or acetic acid, but on acid phosphate of ammonia, which salt keeps the phosphate of lime in a state of solution (*e*). That the circumstances stated by Magendie, to wit, the absolutely or relatively increased quantity of uric acid, and diminished temperature of the urine, is the cause of the precipitation of the uric acid, Wetzlar has indeed too confidently denied; since uric acid, when, from its being in excess, it is free, and not combined with ammonia, must, on account of its insolubility, be disposed to precipitation. That the sediment of uric acid in critical urine takes place only when it is cooling, may be readily explained by the ammoniacal state of the urine, which exists in such cases. Perhaps the precipitation of the uric acid is rarely the result of its increased quantity, and rather to be met with in gravel than in the actual formation of stone; and the doctrine laid down by Prout is more commonly correct, namely, that the uric acid is often precipitated only because another free acid, as the phosphoric, sulphuric, hydrochloric or carbonic, purpuric or acetic is produced. In consequence

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(*a*) Taylor's Catalogue, part ii. p. 252.

(*b*) Litologia Umana—Archiv. Gen. de Med. 1819, vol. iii. p. 444.

(*c*) Above cited, p. 93.

(*d*) Taylor's Catalogue, part i. pp. 132, 133.

(*e*) Heidelb. Jahrbücher 1823. No. 49.

of this, the ammonia entirely or in part quits the uric acid with which it was in combination, and is precipitated pure, or combined with a little ammonia; but not, as Wetzlar supposes, by the soda being withdrawn.

According to Liebig (*a*), there is produced, by the action of the uric and hippuric acids upon the phosphate of soda, an acid salt of soda from these acids on the one side, and an acid phospate of soda on the other side. From which, and from the sulphates contained in the urine, he deduces the acid condition of the fluid.

1990. To attribute the development of such an acid in the urine from an excess of acidity of the juices, cannot be considered groundless, on account of Magendie's assertion that acids do not pass into the blood. If we cannot, indeed, prove the presence of free acids in the blood, as it has always an alkaline nature, yet, it is to be remembered, that if even no free acid can be found in the blood, yet from its approximation to a neutral state a change is caused, which renders possible the secretion of free acids through the urine. To this former opinion of Magendie's, a later one, advanced in an essay read before the Académie des Sciences, on the 18th of September, 1826 (*b*), stands opposed, where he brings forward the daily use of sorrel, which contains much oxalic acid, as the exciting cause of almost every stone consisting of pure oxalate of lime. With this, also, Howship's (*c*) observations agree, which show that if a patient, who, on account of phosphatic gravel, has used acids, take more acid than is necessary to neutralise the alkaline condition of the urine, and to dissolve the precipitated earthy constituents, the white gravel indeed disappears, but red, uric acid gravel is soon produced in its stead. Morichini's (*d*) experiments also support this view; he found that people who have lived long, and almost exclusively upon sour fruit, present citric and malic acid in their urine. But Woehler's (*e*) experiments are still more conclusive.

Strong mineral acids are not capable of rendering the urine acid, probably because their strong affinity for the soda in the blood destroys its combination with the *albumen*, whereby neutral salts are formed, which pass off as such with the urine.

Oxalate of Lime.

1991. Walther doubts whether simple oxalate of lime and the connecting material can form urinary stones. It is frequently found as the nucleus of a stone, though never alone, but combined with uric acid and urate of ammonia. In the layers it is most commonly found with phosphates (*f*). The inquiries of Rapp, however (*g*), and the stone from six to seven lines long and two thick, noticed by Magendie, and examined by Desprets, which consisted almost entirely of pure oxalate of lime, are in favour of the possibility of such a formation; as well, also, as that gravel and formless sediment, according to Prout, is never combined with uric acid.

1992. Prout believes that the oxalic acid is produced by the decomposition of the uric acid, as in urinary stones a nucleus consisting of uric acid is frequently found, surrounded with oxalate of lime; thus the oxalic

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(*a*) Above cited, p. 193.

(*b*) Revue Medicale, 1826, vol. iv. p. 140.—Froriep's Notizen. 1826. No. 33.

(*c*) A Practical Treatise on the Symptoms, Causes, Discrimination and Treatment of some of the most important Complaints that affect the Secretion and Excretion of the Urine. London, 1823. 8vo.

(*d*) Meckel's Archiv. für die Physiologie, vol. iii. p. 467.

(*e*) Versuche über den Uebergang von Materien in den Harn; in Tiedemann's Zeitschr. für Physiologie, u. s. w., vol. i. p. 125.

(*f*) Above cited, p. 208.

(*g*) Ueber Harnsteine; in Naturwissenschaftlichen Abhandlungen, vol. i. p. 138. Tübingen, 1826 *diathesis* follows that of the uric acid, and are allied to each other. He does not, however, suppose that the oxalic acid is in any way produced in the urine by the action of the hydrochloric acid upon the urine; but he considers it more probable, that the oxalic acid has been already secreted as such from the diseased parts of the kidneys; this oxalic acid then comes in contact with the uric acid which is secreted by the healthy part of the kidneys, and throws down from it the lime, in a state of oxalate; perhaps at first in a plastic form, as the somewhat crystallized state of such stones would make us suppose. Walther contradicts this statement (*a*), as the origin of oxalic acid is more easily deduced from the conversion of the benzoic acid, (which is so similar to it,) free carbonic acid, or lactic acid, contained in the urine, than from the uric acid; for, in oxalic acid, as well as in other vegetable acids, hydrogen and carbon are the oxidizable bases, but the urea is a very azotized production of animal life. Oxalic acid is formed in the urine, not only when the hydrogen is wanting, in order to saturate all the relative excess of oxygen, and to combine with it as water, but also the nitrogen, as the acid which would be otherwise formed would be uric, which is distinguished from the oxalic acid by the quantity of azote. A relative want of hydrogen seems in all cases to be one of the conditions of the formation of stones, whether concretions of uric acid or of oxalate of lime. Liebig, Willis, and Jones have held the conversion of uric into oxalic acid, as the consequence of a diminished oxygenation.

1993. Besides the production of oxalic acid by the conversion of the uric acid, its origin from the food must also be admitted. In support of this opinion, it must be observed that various vegetables which serve for food, contain a large quantity of oxalic acid; that Magendie has noticed the production of a stone of oxalate of lime, after long-continued use of sorrel; that in England, where animal food is the most common diet, stones of oxalate of lime are, in comparison with those of uric acid, more rare, whilst, on the other hand, in those countries where chiefly vegetables are eaten, the oxalic stones are much more frequent, as Rapp has noticed in Würtemberg, Walther in Bavaria, and I myself in our own neighbourhood. Woehler has, by his experiments, put beyond all doubt the transition of oxalic acid into the urine.

1994. That under the above-mentioned circumstances, which cause the presence of oxalic acid in the urine, the uric acid may also at the same time be diminished, depends on the greater quantity of vegetable food, but is not to be considered a condition for the production of oxalic acid. The ordinary combination of oxalate of lime with uric acid, or urate of ammonia, contradicts this. Wetzlar's (*b*) assertion, that mulberry stone is most frequent in childhood, when but little uric acid is contained in the urine, has been disproved by the observations of von Walther, Rapp, and others (*c*).

1995. If oxalic acid occur in the urine, on account of its greater affinity for lime, it takes the latter from the phosphoric acid. In proportion as the phosphate of ammonia existing in the urine is in a more or less acid state, the phosphoric acid may unite partly with this, and partly with the ammonia combined with the uric acid; and from these different circumstances we may explain how the oxalate of lime can be precipitated either

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(*a*) Above cited, p. 219.

(*b*) Above cited, p. 55.

(*c*) Chelius, Ueber Scrotalsteine; in Heidelb. Med. Annalen, vol. i. pt. 1.

alone or in combination with uric acid, or urate of ammonia; how the oxalic *diathesis* is preceded or followed by the uric, and how both *diatheses* stand in near relation to each other. These occurrences may also be explained by deriving the oxalic acid from conversion of the uric acid.

Cystin.

1996. Stones of *cystic oxide*, first discovered by Wollaston, are rare, although Civiale believes that cystic oxide is much more frequently present than has been hitherto supposed. They usually consist entirely of this substance; whence it has been concluded that the cystic oxide *diathesis* prevents the formation of other stones more than any other *diathesis* (*a*). Wollaston had seen two stones of cystic oxide covered with a loose layer of phosphate of lime. Bird (*b*) has, from chemical examination, disproved the assertion that the cystic oxide *diathesis* is never present with other *diatheses;* the simultaneous presence of the uric acid *diathesis* is proved by cases in which stones of cystin have been observed, where the patients, either before or after, have passed stones of uric acid. Yelloly found a stone of cystic oxide, with a *nucleus* of uric acid, in a child, in whom a new stone was formed a year after, which had also a *nucleus* of uric acid, though its exterior consisted of phosphates: a stone of uric acid had as its *nucleus* a small portion of cystic oxide (Henry); a stone of oxalate of lime had been previously removed (Prout); Civiale found one stone of cystic oxide in the bladder, and one of phosphates under the prepuce; Lassaigne found a small quantity of phosphate and oxalate of lime combined with cystic oxide (*c*).

1997. The circumstances under which stones are formed from cystic oxide have, in reference to the place where they are produced, the greatest analogy with those which attend the formation of uric acid and oxalate of lime. They are principally formed in the kidneys, and their origin is to be considered as the consequence of a transformation of the urea, or of the uric acid, to which the cystic oxide is allied by its nitrogenous contents. According to the experiments of Thaulow and others, cystic oxide contains, besides carbon, hydrogen, nitrogen, and oxygen, a large quantity of sulphur ($C^6 N^2 H^{12} O^4 S^2$.) It is a peculiar circumstance, that persons of the same family are affected with stones of cystic oxide, as out of twenty-two cases of such stones, ten occurred in four families, in which sometimes two, sometimes three individuals were subject to them, and among these, in three instances, brothers (*d*).

Xanthic Oxide.

1998. The *xanthic oxide*, *uric oxide*, first mentioned by Marcet (*e*), and more precisely defined by the inquiries of Woehler and Liebig (*f*), occurs very rarely. The earlier opinion that it was nearly allied to, perhaps only a modification of uric acid, has been confirmed by the observations of Woehler and Liebig, who have proved that it has the same constituents as uric acid, but with one atom less of oxygen; that uric acid and xanthic oxide are radically the same, but in two different stages of oxidation ($C^5 N^4 H^4 O^2$.) Xanthic oxide, however, is never found in

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(*a*) Marcet, above cited, p. 77.

(*b*) Guy's Hospital Reports, vol. i. p. 492.

(*c*) Civiale, 511.

(*d*) Civiale, above cited, p. 608.

(*e*) Above cited, p. 85-94.

(*f*) Poggendorff's Annalen, vol. xli. p. 393. 1837 solution, nor as a precipitate in the urine; yet it is probable that it occurs in the precipitates from uric acid (*a*).

Besides the stone which MARCET mentioned, and that which LIEBIG and WOEHLER examined, LAUGIER (*b*) has also examined a xanthic oxide stone.

BERZELIUS (*c*) believes that he has sometimes met with xanthic oxide, or acid in gravel.

Phosphate of Ammonia and Magnesia.

1999. As the acid property of urine depends on the acid phosphate of ammonia, which salt contains phosphate of lime in solution, it necessarily follows that every change of the urine, in which alkalescence becomes prevalent, whereby the acid which holds those earths in solution is neutralized, causes the precipitation of those earths. This applies also to the neutral phosphate of lime, if further observations should prove the possibility of its forming the *nucleus* of stone; as also to the combination of phosphate of ammonia and magnesia, and of phosphate of lime, which MARCET has described by the name of *fusible calculus.*

JONES (*d*) divides the phosphate *diathesis* into true and false; in the former, the urine, in consequence of the general state of the constitution, becomes alkaline, and the phosphates are precipitated; in the latter, the alkalescence depends on retention of the urine, or on a diseased secretion of it, which causes a speedy change of the urea, as in irritation of the mucous membrane of the *urethra*.

Connecting Material.

2000. The *connecting material, animal mucus,* exists in gravel, but specially in all stones, in various quantity, and appears to be subject to different changes in the several kinds of stones. Upon the presence of this material, many ground the distinction between the formation of stone and the secretion of gravel and sand. Others hold that such connecting material is not required for the production of stone, inasmuch as the attraction of the individual constituents suffice for its formation. If we reflect that the inner surface of the urinary organs is naturally overspread with *mucus;* that in persons troubled with gravel, there is often as great irritation of the urinary passages, as in stone patients, whereby an increased secretion of *mucus* is caused; further, that in actual blennorrhœal affections of the mucous membrane of the urinary passages, with copious secretion of viscid *mucus*, the latter is often mixed with much sand, and yet no stone forms: it follows that the difference between gravel and stone cannot be derived from this connecting material alone. The difference appears for the most part to rest in this; that in the production of gravel and sand, the precipitation of the substances forming them follows quickly, and in large quantity from any great excess of living; whilst in the formation of stone, it is slow but more continuous (*e*).

2001. According to what has been hitherto said about the production of gravel and urinary stone, it may be attributed to two principal causes, to wit, *an increased acidity of the urine from the acid naturally existing in it being secreted in greater quantity, or from a new acid being developed;* and, *an increased alkalescence.* The remote causes may be luxurious living, excess, the use of strong wine, want of exercise, mental exertion, especially after eating, the use of food difficult of digestion, as

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(*a*) WILLIS, R., p. 108; and on the contrary JONES, p. 105.

(*b*) Journ. de Chimie Méd., vol. v. p. 315. 1829.

(*c*) Lehrbuch der Chemie, vol. ix. p. 491.

(*d*) Above cited, p. 74.

(*e*) HENRY; above cited, p. 134.

heavy, milky diet, sour beer, sour wine, cider; acidity and irregularity of the bowels, the use of vegetables containing oxalic acid, and circumstances connected with climate, as low marshy districts. To these may be added the hereditary disposition, specially observed in gravel. In the same manner, the relation between gout and certain kinds of stone, is to be explained; as also its more frequent occurrence in certain districts, in advanced age, and in the male sex. According to Deschamps (*a*), the latter peculiarity is only apparent in women, as on account of the shortness and width of the *urethra*, little stones readily pass and more rarely need the operation; experience, however, refutes this. Stone is as frequent in children as in advanced age, and in them the production of stone is in close relation with scrofulous and ricketty disposition, and with disturbed development of the bony system. Therefore, also, in children, urinary stones contain relatively less uric acid, but on the contrary, more phosphate of lime, and phosphate of ammonia and magnesia, and the contrary proportions occur in the urinary stones of old gouty persons (*b*.)

[The *calculi* of children consist almost invariably of urate of ammonia. After they have caused irritation in the bladder, they become coated with the mixed phosphates, like all other concretions.—T. T.]

2002. Foreign bodies introduced into the urinary passages, become covered with a crust of phosphatic salts, or often with some uric acid (1). The general opinion is that the phosphatic salts of urine arrange themselves and form incrustations around the foreign body, according to the same laws by which a foreign body put into a solution of salt, hastens crystallization in it. According to Prout, however (*c*), these incrustations arise because the irritation of a foreign body causes an excess of phosphatic salts to be produced; or because the foreign body enters the bladder at a time when the urine there is disposed to incrustation from excess of phosphates. Such foreign bodies as serve for the *nuclei* of these incrustations pass either through the *urethra* into the bladder (2), or through wounds (3), or they are swallowed and penetrate through the intestinal canal into the bladder (4). Blood, sloughs, and the like may also be the *nuclei* of stones. This is indeed doubted by von Walther, but there are stones which have cavities within them, and it is probable that the *mucus* of the bladder, or a similar albuminous animal substance had, at an early period, filled it, and in the course of several years had dried up. Deny's (*d*) experience also appears to agree with this view. But Walther's opinion is most decidedly contradicted by Lisfranc's (*e*) observation; he found in an urinary stone, as big as the fist, a blackish *nucleus* of slight consistence, which resembled a clot of blood, and on chemical examination, presented a fibrinous substance (5). One of the just-named animal substances may also be deposited on the *nucleus* of a stone, over it again a stony mass, so that, if in such stones the enclosed animal substance be dried by time, the *nucleus* no longer appears to fill up the cavity, and when shaken, it

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(*a*) Traité Historique et dogmatique de l'Opération de la Taille, vol. iv.

(*b*) Walther; above cited.—Yelloly, Remarks on the tendency to Calculous Diseases; with Observations on the Nature of Urinary Concretions, and an Analysis, &c.; in Phil. Trans., 1829, p. 55.—Eschirsch, Ueber Lithias; ihre medicinische Begründung in zoologischen Bodenverhältnissen und ihr Zusammenhang mit Ausbildung des Scelet-Systems; in Med. Correspondenzblatt bayerischer Aerzte. 1843.—Textor Curnin, Versuch über das Vorkommen der Harnsteine in Ostfranken. Würzburg, 1843.

(*c*) Above cited, p. 181.

(*d*) De Calculo, p. 14.

(*e*) Archives generales de Medecine, 1827, vol. i. p. 1 .

moves and rattles. Two examples in my collection of urinary stones prove this (*a*).

Cruvelhier (*b*) showed, in the Anatomical Society at Paris, a very large urinary stone, of which the *nucleus* was originally a clot of blood.

[(1) The circumstance of a foreign body in the bladder becoming coated by uric acid is exceedingly rare. There is only one specimen of the kind in the Museum of the Royal College of Surgeons. It has a splendid piece of steel for its *nucleus*, A 126.—T. T.

(2) The quickness with which catheters, especially those of elastic gum are coated with earthy deposits after remaining constantly in the bladder for three or four days, is known to every one who has had the least experience. Upon this account, it becomes necessary when a catheter is constantly worn, that if elastic, it should be replaced by a new one, or if of silver or other metal, should be withdrawn, cleaned, and returned every four or six days, otherwise the deposit upon that part of it in the bladder becomes so considerable, that it will often be removed with difficulty, and almost always scrape the *urethra* as it is withdrawn, and add much to the patient's uneasiness. There are few Museums which have not specimens of extraneous bodies introduced into the bladder, which have become *nuclei* of stones. In the College Museum, there are examples of a silver bodkin, of a sewing needle, of a pea, a hat-pin, a bougie, a piece of bone, &c. There are also two instances in which soap has formed the *nucleus*. It is probable that in these cases "a solution of soap had been injected into the bladder; mutual decomposition of the soap and the salts of urine has been the necessary result; the alkali of the former uniting with and forming soluble compounds with the phosphoric and other acids of the urine, while the earthy bases of the urine have precipitated, in combination with the fatty acids of the soap, in the form of a semi-gelatinous sparingly soluble compound, being in fact an earthy soap, consisting of margarate and oleate of lime" (*c*). In the Museum at St. Thomas's, there is a stone having a large piece of brass nail as its *nucleus*. And another stone of good size, and about an ounce in weight, which had formed nearly on the middle of a female catheter, that had escaped from the fingers of the Surgeon, whilst drawing off the water, who, fearful of getting into trouble, said nothing about the accident. Some months after, the woman had symptoms of stone, and was cut by Astley Cooper; the catheter lay across the bladder, and its ends were pretty tightly fixed; but one end having been freed by introducing the finger, it was easily withdrawn. Brodie (*d*) mentions a hazel nut as forming the *nucleus* of a stone in a female; and in another case, a man occasionally subject to retention of urine "passed a flower stalk through the *urethra* into the bladder, using it as a bougie. In an evil hour, the extremity of the flower stalk, was broken off, it became incrusted with calculous matter forming the *nucleus* of a stone," for which he was operated on by Everard Home. He also mentions some small oblong stones from a female bladder, "each of which has a small fine hair running longitudinally through its centre."

(3) In St. Thomas's Museum there is a beautiful example of a pin forming the *nucleus* of an oblong stone. The child, a male infant, had been put upon the floor by his nurse, and immediately began to scream violently, and without any apparent cause. Some months after he had symptoms of stone in the bladder, for which he was cut by Astley Cooper, and this stone removed. Foreign bodies of such size are sometimes pushed up into the *vagina*, and slip beyond reach of the patient, who, being ashamed of making her condition known at the time when she might be relieved, the foreign body remains fixed, and will produce ulceration of that part of the bladder against which it presses, and incontinence of urine; at the same time also it becomes more or less covered with calcareous deposit. The College Museum has a remarkable instance of this kind, H. a. 13. "A tumbler in an entire state was introduced into the *vagina* of an unmarried female, about twenty years of age. On her attempting to withdraw it, its upper edge was broken, by which the bladder was wounded, and incontinence of urine produced. In this situation it remained for nearly two years, when it was removed by Mr. Anthony White, who, finding the tumbler to be closely embraced by the *vagina*, and quite immovable, broke away the sides of the glass with instruments having notches, filed at their extremities like the wards of a key, until he was enabled to introduce a lever behind it. * * * A large horizontal slit was found in the bladder immediately above its *cervix*" (*e*). My friend Arnott tells me of a woman, about forty-two years of age, admitted into the Middlesex Hospital with presumed disease of the *uterus*, and with incontinence of urine. On examination, a gallipot was found in the *vagina*, mouth

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(*a*) Eggert, Versuch. die Entstehung des Blasensteines zu erörtern; in Rust's Magazin, vol. xiii. pt. iii. p. 367.

(*b*) Behrend's Allgemeines Repertorium, p. 75. 1823, Oct.

(*c*) Taylor's Catalogue, part i. p. 129.

(*d*) Lectures, above cited, p. 245.

(*e*) Taylor's Catalogue, part i. p. 129.

downwards, and coated inside and out with what proved to be triple phosphate. An attempt was made to extract it whole by the application of large-bladed stone-forceps, but the pot was so closely impacted by the swelling of the external parts, that only one blade could be introduced. It was therefore broken with strong forceps, and removed piecemeal with difficulty. The finger being then introduced into the *vagina*, a large aperture was found into the bladder, in which was a large stone. As she was much exhausted, the removal of the stone was deferred for a few days, and then removed by enlarging the aperture. In the course of a few weeks she was able to retain four ounces of urine in the bladder which she had not been able to do for many years.

(4) In the College Museum is an example, H. a. 14, of a pin, which had been swallowed five years, forming the *nucleus* of stone in a young man of twenty-two years of age, which had caused symptoms only the latter two years. It was removed by the lithotritic operation.

(5) ASTLEY COOPER mentions a case in which, having removed a triple phosphate stone, "the disease returned, and he again performed the operation, and found a large coagulum of blood in the bladder surrounded by a triple phosphate deposit" (*a*). In the College Museum there is a stone H. a. 7, "consisting of uric acid, deposited upon a hollow crust or shell of impure oxalate of lime. This crust was most probably formed upon a clot of blood, which has afterwards shrunk" (*b*).]

2003. Urinary stones are divided according to their situation, the mode in which they arise in the urinary passages, according to their external differences, and according to their chemical composition.

2004. According to the *situation* where they are found stones are distinguished as—

a.	*Renal Stones*	*Calculi renales*	*Nierensteine.*
b.	*Ureteric* ,,	,, *ureterici*	*Steine in den Harnleitern.*
c.	*Vesical* ,,	,, *vesicales*	*Blasensteine.*
d.	*Urethral* ,,	,, *urethrales*	*Steine in der Harnröhre.*
e.	*Stones which form in collections of urine in the cellular tissue.*		

Stones either lie *loose*, or they are firmly *enclosed* by the walls of the cavity, or are *connected with* them.

2005. The *external characters* of stones are very different, and a division founded upon such difference is only so far of value as it gives sometimes a clue to their internal chemical composition. Their structure is more or less solid, granular, sandy, chalk-like, crystallized, friable, brittle; their surface is smooth, tubercular, mulberry-like; their interior compact, homogeneous, laminated, consisting of various layers. The layers usually show mixed and varied colours, as gray, white, reddish-yellow, brown, black, violet, and so on. The middle or *nucleus* (*Kern*, Germ.; *Noyau*, Fr.) of the stone is formed either of a foreign body or consists of one of the substances already mentioned (*par.* 1988.)

Stones composed of uric acid have a brownish or yellowish colour, a smooth, but sometimes tubercular surface, a radiated fibrous fracture, and mostly an oval or flattened form; when cut through, they are generally found made up of concentric layers.

Stones formed of urate of ammonia have nearly the same figure as those of uric acid, but have a milk and coffee colour; they are composed of concentric layers; their fracture is very close and similar to that of a hard chalk stone.

Mulberry stones, however complicated they may be, contain in their *nucleus* or in their layers oxalate of lime (1). Their colour is dark brown, approaching to black; they are hard, when cut through present an imperfectly lamellated structure; they rarely exceed a moderate size. If in

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(*a*) Surgical Lectures, vol. ii. p. 242.

(*b*) TAYLOR's Catalogue, part i. p. 85.

these stones there be not this irregular surface, the cause seems to be the simultaneous existence of several stones, and their consequent friction (*a*).

Marcet's *hempseed stones* are smooth, contain oxalate of lime (2), and are pale coloured.

Stones consisting of the earthy phosphates have a white or grayish-white colour, are friable, and brittle, and only in rare cases hard and compact, and when broken they present a crystalline and more or less transparent structure.

The *stone consisting of phosphate of lime* has mostly a pale-brown colour, is smooth as if polished; its structure consists of regular plates, which are striped perpendicularly to their surface; it is rare, and seldom attains moderate size (*b*).

The *stone, consisting of a mixture of phosphate of lime and phosphate of ammonia and magnesia* (*fusible stone*) is usually white and very friable. It resembles a lump of chalk, and leaves a whitish stain on the fingers; it is in general not laminated, but sometimes separates into layers, the interspaces of which are often filled with glittering crystals. Those which have no layers often attain considerable size.

The *cystic oxide stones* are usually crystallized throughout, yellowish, semi-transparent, iridescent; if examined with a lens, an irregular grouping of granules is observed, which, in large stones, are separated by interspaces; this, according to Civiale, seems to prove that the cystin is not deposited on its *nucleus* in a fluid form, and this appears from the structure of the stone, which, at least in its pure state, is wrinkled like shagreen. These stones are usually small, and do not exceed the middle size. Civiale has, however seen three stones of this sort of considerable size (3). When cystic oxide is combined with other substances, for instance, with earthy substances, the stones appear to be so modified by the nature of their combination and the proportions of their constituents, that there is great uncertainty about the nature of the stone.

Stones of xanthic oxide have a pale-brown, smooth, glossy, in part whitish, soft and earthy surface; when broken they have a brown flesh-colour. They are made up of concentric and easily separable layers, and have not any crystalline or fibrous structure. By rubbing they become smooth, with a wax-like gloss, and have nearly the same hardness as stones of uric acid.

Those *stones which contain carbonate of lime* are of a chalky colour, hard, and friable. Smith (*c*) has described stones of this kind, which closely resemble mulberry stones.

Urinary stones sometimes smell of urine; in sawing them through some have a peculiar animal odour, resembling sawn bone or musk; many have no smell at all; a few have a distinct and well-marked flavour. Their size is very various; it appears, however, in some degree relative to their composition. Their shape depends on the place in which they are found, and partly on their number (4).

[(1) Several mulberry stones have a *nucleus* of uric acid.

(2) Hempseed *calculi* consist either of oxalate or of urate of lime, either pure or mixed with urate of ammonia.

(3) A cystic oxide stone found in the Museum of St. Bartholomew's Hospital, half

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(*a*) Martres, Sur des Concrétions d'Oxalate du Chaux, qui ne sont pas murales; in Annales de Chimie et de Physique, vol. vi. p. 220.

(*b*) See *par.* 1988 (*note.*)

(*c*) Medico-Chirurg. Trans., vol. xi. p. 14.

of which is now in the College Museum, weighed, when entire, 740 grains. Another specimen, in the Museum of University College, (London,) weighed 850 grains.

(4) Only three xanthic oxide stones have ever been seen:—Marcet's, which weighed only eight grains; Langenbeck's, about the size of a small hen's egg, first examined by Stromeyer, and afterwards by Liebig and Wöhler; and that described by Laugier.—T. T.]

2006. The division of stones according to their chemical composition has been arranged in various ways by Fourcroy, Brande, Thomson, Wollaston, Marcet, Yelloly, and Taylor, and the grounds upon which this division has been founded are either the simple or compound nature of the stone, or the prevalence of one or other substance. It seems most convenient to divide urinary stones according to the principles laid down by von Walther, who gives the acids entering into their composition as their distinguishing characteristics.

2007. According to these principles may be distinguished:—

First, *Urinary incrustations of foreign bodies.* These consist of *phosphates*, often also with some *uric acid.*

Second, *Urinary concretions* without foreign bodies.

a. *Stones of pure uric acid or urate of ammonia.* These are soluble in the fixed alkalies, with or without giving off ammonia.

b. *Stones which contain oxalate of lime.* This is found in the *nucleus*, either pure or commonly combined with urate of ammonia, most commonly in the interspaces between the *nucleus* and the crust, which latter usually consists of phosphates. Sometimes they contain a little silica in a state which is still questionable. They are insoluble in alkalies, and soluble with difficulty in dilute acids.

c. *Stones consisting of cystic oxide*, sometimes covered with a crust of phosphate of lime. A piece of cystic oxide placed upon ignited charcoal gives out a garlicky or phosphoric smell; on a platina plate, heated to redness, its sulphur blackens the plate to the extent of some lines.

d. *Stones of xanthic oxide*, soluble in hydrochloric acid, although with more difficulty than uric acid, without the least development of gas, form, after evaporation, a lemon-coloured residuum, which dissolves in water with a pale yellow colour.

e. *Stones consisting of phosphoric acid in combination, so as to produce neutral salts*, either of *phosphate of lime* or *phosphate of ammonia and magnesia*, simply or combined, with *phosphate of lime;* or they have a *nucleus* of *uric acid* or *urate of ammonia*, and the crust consists of *phosphates*, or of *these* and alternating layers of *uric acid.*

f. *Stones containing carbonate of lime.* These have a *nucleus* of urate of ammonia, and the carbonate of lime is mixed with *phosphates.* They effervesce with acids.

2008. The *frequency of the different kinds of stones* varies according to the circumstances of climate, mode of life, and so on. The uric acid stones, however, occur most frequently, so that, according to Prout, they make one-third of the whole number. To this may be added, that uric acid, in most other instances, forms the *nucleus* around which other layers are deposited, so that its frequency may perhaps be estimated at two-thirds. Oxalate of lime stands next to uric acid, and then follow the phosphates.

If the number of substances composing stones be reviewed, they may be divided into simple and compound, thus:

Simple. 1. uric acid; 2. urate of ammonia; 3. oxalate of lime; 4. phosphate of lime; 5. phosphate of ammonia and magnesia.

Double. 1. uric acid and phosphates; 2. uric acid and oxalate of lime; 3. urate of ammonia and phosphate of ammonia and magnesia; 4. phosphate of lime and phosphate of ammonia and magnesia.

Triple. 1. uric acid and both phosphates; 2. urate of ammonia and both phosphates; 3. oxalate of lime, with uric acid or urate of ammonia and phosphates; 4. carbonate of lime, with phosphate of lime and iron.

Quadruple. 1. uric acid, with oxalate of lime and phosphates; 2. uric acid, with urate of ammonia, silica, and a phosphate.

Quintuple. Uric acid, with urate of ammonia, oxalate of lime, and phosphates.

[*Amorphous Urinary Sediments.*

The deposits from the urine, either as mere sediments without form, or in a state of crystallization, as gravel, are of so great importance, both as regards themselves, and in reference to the production of stone, that I have taken the liberty of supplying the deficiency of the special consideration of the subject of urinary sediments in Chelius's work, by the following extracts from the excellent work of Dr. Prout.

"*Lithic* or *Uric Acid Sediments.* These sediments assume at different times very different appearances, especially in point of colour; and they occur at different times, and in different persons, of almost every shade of colour, from nearly perfectly white to deep mahogany brownish red. * * * I shall consider them under three heads only, which will be found quite sufficient for all practical purposes, namely: *first*, yellow sediments; *second*, red or lateritious sediments; and *third*, pink sediments.

"1. *Yellow Sediments.* These sediments vary in colour, from nearly white to the wood-brown of Werner, a colour which is stated to be identical with that of ripe hazel nuts. They consist essentially of the lithate (urate) of ammonia, tinged with the colouring principle of the urine, but usually contain more or less of the phosphates, and sometimes a little of the lithate (urate) of soda. In general, perhaps, the nearer they approach to white, the more of the phosphates they contain; but there are many exceptions to this, and I have seen sediments belonging to this class almost perfectly white, and consisting of nearly pure lithate (urate) of ammonia. This class of sediments may be termed the *sediments of health*, if the term may be allowed, being such as are produced in the urine of healthy or slightly dyspeptic individuals, by errors of diet and all the other circumstances before mentioned which seem, independently of actual fever, to procure turbid urine. Perhaps there is no healthy individual whose urine does not occasionally deposit this species of sediment. * * * When these sediments are of an unusually pale colour, as is sometimes the case, a tendency to the phosphates is indicated. Children are very subject to this form of sediment; and in them, as well as in all who labour under such a susceptibility, it is frequently the forerunner of gravel or *calculus.* Indeed nothing is more common than for this form of sediment to alternate in the urine of the same person with the crystallized sediment, or *gravel*, to be presently described.

"2. *Red* or *Lateritious Sediments.* These sediments vary in tint from nearly white, in which state they are with difficulty distinguished from the last variety, to a deep brick-red or brown. They consist essentially of the lithate (urate) of ammonia, or lithate (urate) of soda, tinged with a large proportion of the colouring principle of the urine, and more or less of the purpurates of ammonia and soda. Sometimes also they contain a small proportion of the earthy phosphates. In general, the deeper the tint, and the more approaching to *brick red*, the more of the lithate (urate) and purpurate of soda they contain; but there are some exceptions to this observation. When the purpurates exist in the urine, (indicating, as was formerly attempted to be shown, the secretion by the kidney of nitric acid,) feverish, or inflammatory action, is almost constantly indicated; and this law is so general, that I have never seen a decided exception. * * * They owe their peculiarity of tint to the colouring matter of the urine, which, in common with all its other principles, appears on such occasions to be secreted more copiously than usual. Hence urine which deposits these sediments is usually of a deep red or brown colour, and of high specific gravity. The deeper the colour of the sediment, and the more approaching to *red*, the more severe in general the symptoms. * * * The urine of all persons labouring under feverish and inflammatory affections, and whose urine is naturally healthy, is liable to deposit this species of sediment. * * * There are certain diseases, also, in which this variety of sediment appears to occur in a greater degree, and in a more decided form than usual; such are gout, also rheumatism, hepatic affections, &c.

"3. *Pink Sediments.* The third and most rare variety of amorphous sediments is what is usually denominated *pink* sediments, the colour of which is very aptly expressed by the term *pink*. Like the other varieties, they consist essentially of the lithate (urate) of ammonia; but they differ from both these, in being almost entirely devoid of the yellow tint derived from the colouring matter of the urine; and consequently, in owing their colour chiefly to the purpurate of ammonia. This class of sediments, therefore appears to indicate the absence of the large proportion of the colouring principle of the urine, so constantly present in active inflammatory fever, and to denote the secretion of a greater quantity of nitric acid, and the consequent formation of more of the purpurate of ammonia. * * * The most perfect specimens of this kind of sediment which I have ever seen, were obtained from the urine of dropsical individuals: they occur also occasionally in the urine of the hectic, and of those obviously labouring under certain chronic visceral affections, especially of the liver." (p. 121–25.)

"Besides these amorphous sediments, consisting chiefly of lithic (uric) acid, I have seen two or three instances in which large quantities of perfectly *white* lithate (urate) of soda were deposited from the urine. In one case, in particular, the quantity was immense, and voided not only mixed with the urine, but in a state of consistency like mortar, especially during the night, so as to produce considerable difficulty in passing the urine. The urine was *acid*." (pp. 127, 28.)

Phosphatic sediments. "The phosphates, like the lithates, (urates,)" says Prout "appear in the urine under two distinct forms, viz., in an *amorphous* state, and in the crystallized form; but here the analogy ceases, for in the case of the lithates, (urates,) the amorphous form is of comparatively the least consequence, whereas when the phosphates are concerned, the amorphous sediment is by far the most important, and the crystallized form is usually of a much milder character." On this account Prout considers "the crystallized form, in the first place, as a preliminary step to the more formidable disease." (p. 174.) It will be more convenient, however, for our present purpose, to reverse his arrangement, and first to notice the *amorphous phosphatic sediments*. "These sediments consist invariably," says Prout, "of a mixture of the phosphate of lime, and of the triple phosphate of magnesia and ammonia.—[*Note.*—I am aware that it is the opinion of many eminent characters, that the inner coat of the bladder is the source of the earthy matters deposited by the urine on these occasions. I do not deny this altogether; but, on the contrary, think that the phosphate of lime, at least, is sometimes derived from this source—the inner coat of the bladder apparently assuming, in such instances, the character of the inner surface of the abscess sometimes found in the prostate gland, which is known to secrete this earthy salt in great abundance. I am doubtful, however, if any portion of the triple phosphate is ever derived from this source, but from the kidney only, from which same source, in various cases, a large proportion of the phosphate of lime is likewise undoubtedly derived.]—The proportions of the two salts vary very much in different instances; but, sometimes, the phosphate of lime seems to constitute by far the greater proportion, and, in this case, the symptoms are commonly much more decided and severe; and it is to this form of the disease that the following observations are to be understood as chiefly applicable. A deposition of the earthy phosphates from the urine has been long observed to be attended by very distressing symptoms, though no one seems to have hitherto generalized them. They consist in great irritability of the system, and derangement of the chylopoietic viscera in general; such as flatulency and *nausea*, obstinate costiveness, or peculiarly debilitating *diarrhœa*, or both frequently alternating; and the stools are extremely unnatural, being either nearly black, or clay-coloured, or sometimes like yeast. These are always accompanied by more or less of a sensation of pain, uneasiness, or weakness, in the back and loins. There is a sallow, haggard expression of countenance; and as the disease proceeds, symptoms somewhat analogous to those of *diabetes* begin to appear, such as great languor and depression of spirits, coldness of the legs, complete *anaphrodisia*, and other symptoms of extreme debility: and the disease, if not speedily checked, seems capable of ending fatally. The urine in this form of disease is invariably pale-coloured, and, upon the whole, voided in greater quantity than natural. Sometimes (generally, I think, by day) it is voided in very profuse abundance, and, in this case, is of very low specific gravity; 1·001 or 1·002, for example. At other times, it is voided in less quantity, and its specific gravity is proportionally higher; but it is seldom very high, that is, surpassing 1·025. In the former case it is generally perfectly pellucid, and colourless, and deposits no sediment; in the latter, it is sometimes opaque when passed, and always, after standing for a greater or less time, deposits a most copious precipitate of the mixed phosphates, in the state of an impalpable powder. In all cases the urine is extremely prone to decomposition, becomes alkaline by the evolution of ammonia, and emits a most disgusting smell.

"With respect to the causes of this complaint, they may be either general or local; for the most part, however, they seem to partake of both characters. A large proportion of those cases which have come under my own observation, has been distinctly traced to *some injury of the back.* This injury has been of a character not very capable of being understood or described; but perhaps some idea of it may be acquired by my stating, that for the most part it has arisen from a fall from a horse, in which the person has received a violent general concussion of the spine, and often at the same time some local injury about the back, but not of such a nature as to confine him long, or to lead him to think that he has received any material injury; and generally it has been quite forgotten till the patient's attention has been called to the subject. Among the general exciting causes may be also mentioned severe and protracted debilitating passions, excessive fatigue, &c. The local causes are generally some irritation about the bladder, or *urethra*, especially when operating constantly for a considerable length of time; as, for example, any foreign substance introduced into the bladder, and producing irritation of that organ, including all sorts of *calculi* under certain circumstances; the retaining of a bougie or catheter in the *urethra;* strictures of the *urethra* in some rare cases, and in particular constitutions; all which, and many other similar causes, are capable of producing, in a greater or less degree, a condition of the urine more or less resembling that above described, and readily depositing the phosphates. Thus it has been long known that any foreign substance introduced into the bladder almost invariably becomes incrusted with the phosphates, and not the lithic (uric) acid. With respect to the proximate cause of this form of disease, we may suppose it to consist in a diminished or suspended action of the usual acidifying powers of the kidneys, and the formation, instead of lithic (uric) acid, of a greater quantity of alkaline matter than natural, as urea, (equivalent to ammonia,) and particularly of magnesia and lime; but this being little more than a simple expression of obvious facts, of course throws no light upon the immediate cause of these depraved actions." (p. 177-82.)

"*Oxalate of lime* very rarely, if ever, appears alone under the form of an amorphous sediment. In some instances, it occurs with the lithic (uric) amorphous sediments; but even this is not very common." (p. 153.)

Cystic oxide. Prout had the opportunity of examining the urine of a man of thirty years old, who had passed a stone of pure cystic oxide. He found it had "a yellowish green colour, and strong peculiar smell. It very faintly reddened litmus paper, and its specific gravity was 1,022. There was a slight deposition on standing for some time, consisting of a mixture of the cystic oxide with a little of the triple phosphate. A considerable proportion of the cystic oxide was precipitated from the urine on the addition of acetic acid, which of course held at the same time the phosphates in solution." (p. 167.)

The *treatment* of these several kinds of sediments will be considered in speaking of the treatment of the various kinds of gravel.]

I.—OF GRAVEL.

(*Sabulum, Arena,* Lat.; *Gries,* Germ.; *Gravelle,* ou *Gravier,* Fr.)

2009. The term *gravel* is applied to sand, or small crystallized stones, of different colour, form, and number, which are voided with the urine. It consists usually of *uric acid*, or *urate of ammonia*, when it is reddish; or of *oxalate of lime*, when it has a dark blackish green; or of *phosphate of ammonia and magnesia*, where it is whitish; or of *cystic oxide*, when it has a bright yellow colour.

Crystalline deposits, of different kinds, are never met with, at the same time, in the same urine, although, not unfrequently, accompanied with formless and dust-like sediment (*a*).

Magendie (*b*) notices a peculiar kind of gravel, in which the sediment of th urine consists sometimes of a small quantity of white powder, with a great number o small hairs, the length of which varies from two lines to an inch and more; sometimes it is whitish, irregular, and of so little consistence, that it may be crushe

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(*a*) Prout, above cited, p. 85. (*b*) Revue Medicale, 1826. vol. iv. p. 140.

between the fingers, without the fragments, which are connected by the little hairs, being separated; but they remain hanging together in a sort of cluster. These hairs can be separated only by maceration. MAGENDIE calls this *hairy gravel* (*gravelle pileuse*); it consists of phosphate of lime, and some magnesia, and uric acid.

GUERANGER (*c*) speaks of a gravel composed of silica.

In reference to xanthic oxide gravel, see *par* 1998.

2010. The symptoms of gravel are very various; sometimes it causes little or no inconvenience; often only in making water: frequently it is accompanied with pain or weight in the loins; the kidneys, ureters, bladder, and *urethra* may be, however, severely irritated; and suppression of urine, inflammation, and fever, may result from it. In most cases it is accompanied with disturbance of the digestive organs, acidity of the stomach, flatulence, and the like. Patients labouring under this disease frequently complain of heat and dryness in the throat and gullet, and are therefore constantly hawking and spitting. The complaint is often accompanied with organic disease of the kidneys, or of the urinary passages. The general health and appearance will often remain good for a long while with deposits of uric acid (1): but phosphatic gravel is always accompanied with symptoms of increased sensibility and irritability, general weakness, disturbed digestion, and unhealthy pale countenance. In phosphatic gravel, the urine is most generally pale, after standing some time a glistening film is formed on its surface, which consists chiefly of phosphates; little crystals often attach themselves to the vessel. The specific gravity of the urine is often very much altered; and it very readily becomes putrid (2).

[(1) "This form of sediment (crystallized uric acid) varies considerably," says PROUT, "in its colour and appearance, according to circumstances. When unaccompanied by fever, its colour is always identical with the deeper tints of that of the first (yellow) class of amorphous sediments before described. When it is accompanied by fever, it is generally more or less of a red or lateritious colour. I have never seen this form of sediment of a *pink* colour, and, for obvious reasons, it is not likely that such an occurrence should take place. Sometimes large quantities of impure or imperfectly crystallized lithic (uric) acid is voided by old people in the shape of globules, varying in size from a pin's head to that of small peas: these are generally pale-coloured Occasionally, also, when the kidney is diseased, large irregular masses of this acid, in an impure state, are voided. * * * Children, in general, and particularly the children of dyspeptic and gouty individuals, or who inherit a tendency to urinary diseases, are exceedingly liable to lithic acid deposits in the urine. * * * If the child be attended to, there will be found to be a frequent desire to pass urine, which is voided in very small quantities, and with manifest uneasiness. The irritation about the urinary organs also frequently induces the child to wet the bed by night, &c. * * * Between the age of puberty and forty, there is, generally speaking, less disposition to the formation of lithic (uric) acid deposits than at any other period of life. * * * About the age of forty, an important change commonly takes place in the constitution, which for the most part materially influences the deposition of lithic acid in the urine. It will be generally now observed that the lithic acid is apt to be deposited at intervals in larger quantities than usual, and that for some time previously to this occurrence, there is more or less of feverish indisposition and derangement of the general health: about this period of life, also, there is a disposition in the constitution, at the above periods particularly, to separate the lithic (uric) acid in a concrete state, thus giving origin to the formation of renal *calculus*. * * * Frequently about the age of sixty or seventy, another change takes place in the mode in which the lithic acid is separated from the system. At this period of life the urinary organs not only begin to participate in the general decay of the constitution, but are apt to be deranged in a particular manner from other causes, and more particularly to suffer from the delinquencies of early life. Frequently, also, they become organically diseased, and this circumstance,

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(*a*) Journal de Chimie Medicale, vol. vi. p. 129. 1830.

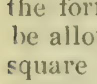
in conjunction perhaps with others that will be noticed hereafter, produces a disposition in the system to secrete neutral urine, or even the earthy phosphates. Under these circumstances, where the urine had previously for years deposited the lithic (uric) acid chiefly in the state of crystals, these will in a great measure disappear, and instead of them, impure or imperfect lithic acid, in the shape of minute globules of various sizes, will be separated from the kidneys in great abundance. In most of these cases, there is a good deal of pain in the back, and irritation about the urinary organs, even when the concretions are only of small size. In others, there is much less irritation under these circumstances than one could imagine. In all instances, however, this may be considered as a most dangerous state of disease, not only from the constant liability of the patient to the formation of renal or vesical *calculi*, which all other circumstances likewise conspire to render probable. But, on the other hand, from the danger there is of suddenly checking the secretion of lithic (uric) acid, which is sometimes followed by great derangement of the general health, and apoplexy." (p. 130–35.)

(2) "Crystallized sediments, composed of the phosphates, *almost invariably* consist," says Prout, "of the triple phosphate of magnesia and ammonia, and exist in the form of perfectly white shining crystals.—[*Note.*—I have said *almost invariably;* for, if I am not mistaken, I have once or twice seen a crystallized compound of the triple phosphate of magnesia and ammonia, and the phosphate of lime. These crystals were much larger than those of the triple phosphate, and less distinctly formed.]—This form of disease sometimes occurs alone, but very frequently it alternates, or is accompanied by the pale-coloured lithic (uric) amorphous sediments, or the amorphous variety of phosphatic sediment." When the triple phosphate of magnesia and ammonia "abounds very much, the crystallized deposit is formed before the urine is discharged from the bladder, and consequently immediately subsides to the bottom of the vessel in which it is passed; in this case, the urine is alkaline when voided: most generally, however, the crystals do not begin to form till the urine has become cool and sometimes not till it has begun to putrify: and these circumstances indicating the periods when the urine becomes alkaline, may be considered as pointing out the degree of severity of the disease. * * * It may be also remarked that children are more subject to this form of deposit than adults; a circumstance perhaps to be referred to the irritability of the system at this age, and the great derangement of the digestive organs to which they are subject." (p. 174–77.)

Oxalate of Lime. "Its appearance is still more rare," says Prout, "under the form of crystallized gravel," than under that of an amorphous sediment. "I have only seen one instance of this, and am able to refer to one more. Brande states, also, that in this *diathesis* there is little or no sand or gravel voided." (p. 153.)

Although oxalate of lime can scarcely be said to form gravel, yet it is very frequently deposited from the urine in the form of small flattened octohedral-shaped crystals. Indeed, as far as my own observation goes, there are very few cases of habitual disorder of the digestive functions, in which this salt cannot be detected in the urine, either alone, or as is most commonly the case, accompanied by uric acid and urate of ammonia. Persons in whom this *diathesis* prevails are usually of a spare habit, with a pale countenance, and have more or less nervousness of manner about them. They usually complain of a feeling of languor, and disinclination to mental or bodily exertion, pain in the loins, and uneasiness and weight, if not of pain, in the region of the stomach, particularly after eating; palpitation of the heart, and a capricious, sometimes an inordinate, appetite, although a small quantity of food produces oppression with nausea. In general they suffer from acidity of the stomach, and are subject to itching and tingling of the skin, boils, and cutaneous eruptions, particularly of the scaly kind. Their urine is generally acid when first passed, and perfectly bright; on cooling, it becomes more or less turbid, from the deposit of urate of ammonia, with crystals of uric acid and oxalate of lime. Sometimes no deposit of urate of ammonia occurs, the urine remains perfectly clear; but crystals of oxalate of lime are to be found entangled in the *mucus* of the bladder, which has subsided to the bottom of the vessel.

In order to detect this salt in the urine, it is merely necessary to allow the urine to stand for some hours, to pour off the greater portion of the fluid, and to place a few drops of the remaining liquid on a glass plate beneath the microscope, using a power of about 200 linear. The oxalate of lime will then, if present, be observed in the form of very regularly shaped highly flattened octohedra. If the drop of urine be allowed to evaporate to dryness, the crystals will appear as squares, with a dark square in the centre, the sides of which face the angles of the outer squares, somewhat resembling this diagram. When much urate of ammonia is present it is well to add some boiling water to the deposit, which dissolves the whole of that salt, and allows the oxalate to be distinctly observed.



The causes producing this *diathesis*, independent of the use of food containing oxalic acid, as rhubarb tarts and sorrel, are those habits which are calculated to diminish the vital energy, and the powers of assimilation, and of these severe mental study, or anxiety, or inordinate venery, appear to me to be the most common. The treatment must be guided by general principles; an entire change of habits, change of air, and a vigorous diet, consisting almost exclusively of meat and bread, with the avoidance of sugar in every form, are the most important circumstances to be attended to.

The nitro-muriatic acid, which has been much recommended, causes certainly in many cases, the oxalate of lime to disappear from the urine, and frequently substitutes that of uric acid. Its use cannot, however, be long persisted in, and without attention to the above rules, it has no permanent advantage.—T. T.]

2011. As to the ætiology of gravel and its various kinds, all that has been already said generally applies, and therefore its indications determine the *treatment.* Its object must be *to prevent the increased production of the acid, or the formation of a new one, and to encourage the removal of the gravel already formed.* If the gravel cause violent pain, difficulty in making water, fever, and the like, these must be got rid of by blood-letting, leeches, cupping on the loins, lukewarm baths, fomentations by calomel with antimony and opium, or *hyoscyamus*, by the introduction of the catheter, and so forth, according to the different state of the patient, and the violence of the symptoms. If there be suspicion of any accompanying local disease in the kidneys after the inflammatory symptoms have been soothed, a large galbanum plaster, an issue, or a seton in the loins may be useful.

2012. In *uric acid gravel*, the excessive production of the uric acid must be prevented, and the excessive acidification of the urine by other acids must be guarded against. The patient must keep to a strict diet, both as regards the quantity and quality of his food; all substances containing much azote, especially salted and dried meats, acid fruits, thin soups, wine, especially that which is acid, and bad beer must be most carefully avoided. The proper action of the skin must be attended to by wearing flannel next the body, and regular relief from the bowels by proper exercise, and avoidance of mental excitement. It must be sought to *neutralize* the acid by the use of *alkalies*, carbonate of soda, of potash, of magnesia. These partly neutralize the acids in the alimentary canal, and in the juices, by which the ever-continuing decomposition of the urate of ammonia is got rid of, and partly by the passing over of the alkalies into the urine, the solution of the gravel is effected. The carbonate of soda and potash must be given dissolved in water, and the dose gradually increased. Frequently during their continued use, the digestion is disturbed, which renders their suspension necessary. Carbonate of magnesia is given either in powder or with mucilaginous fluids; it is less effective, but more easily borne. According to PROUT (*a*), if these remedies are to be really efficacious, they must not be given alone, but combined with alteratives and purgatives. A pill of calomel and antimony should be given at night, and a solution of Rochelle salts and carbonate of soda in bitter drink next morning. Through the day this mixture should be taken twice or thrice, or a little magnesia in a glass of soda water. This treatment must be continued for a certain time, according to the severity and obstinacy of the symptoms, and the alterative pills given at more distant intervals, with a corresponding diminution of the doses of the other medicines. If violent irritation also exist, opium, or *hyoscyamus*, which is still better, must be

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(*a*) Above cited, p. 78.

employed. Hydrocyanic acid may be given with advantage in flatulence and acidity of the stomach; and, if there be gouty complication, the *vinum seminum colchici.* This treatment must, however, be modified according to the circumstances of the case. The easier discharge of the gravel is promoted by drinking much water, or any diuretic mineral water, as that of Vichy, Wildungen, Selters, Carlsbad, and the like.

WETZLAR (*a*) proposes for uric acid gravel a solution of borax, as it dissolves the uric acid with great readiness, and perhaps acts less injuriously on the digestive organs than alkalies.

The peculiar property of vegetable acids, combined with alkalies, being converted in animal bodies into carbonic acid, and as such to pass into the urine, led to the proposal of employing them instead of carbonic acid, as they are more easily borne than it, and allow of greater variety. Most vegetable alkalies can be used for a length of time, and in large quantity, without disturbing the digestion, and are not unpleasant to take, as the supertartrate, tartrate, and borate of potash, Seignette salts, acetate and citrate of potash and soda; cherries, strawberries, and different kinds of fruits (*b*).

According to JONES, the question of the treatment of the uric acid *diathesis* depends upon which way the greatest oxygenation can be produced upon the uric acid in the body. This appears to be attainable, *first*, by the large addition of oxygen, as by exercise, cold air; by medicine, as carbonic-acidized waters and iron; *second*, by the diminution of the other substances on which the oxygen acts more easily than on the uric acid, that is those bodies which consist of hydrogen, carbon, and oxygen, by their exclusion from the food, and their removal by purging and sweating remedies; *third*, by retaining in solution all the uric acid formed, by means of water and alkalies.

Upon the effect of vegetable diet on the diminution of uric acid, compare LIEBIG upon the composition of the urine (*c*). WILSON PHILIP (*d*), on the contrary, has come to the conclusion, after a number of experiments, that a diet for the most part animal diminishes the deposit of uric acid, and increases that of the phosphates.

["Different doses of the alkaline remedies will be required," says BRODIE, "in different instances. Indeed a good deal of care is generally necessary to adjust the dose to the peculiar circumstances of the individual case. If you give too little of the alkali, the result is not obtained, and the lithic acid is deposited, although in smaller quantity. If you give too much, you not only prevent the formation of the red sand, but you render the urine alkaline and a white sand (the triple-phosphate of ammonia and magnesia) is deposited in its place. Other ill consequences follow the too liberal exhibition of alkalies. They alter the quality of the blood. After some time the patient is liable to *petechiæ;* he perspires too easily; becomes low-spirited, and less capable than when in health of physical exertion. Magnesia does not produce these effects at any rate, not to the same extent, as no more of it can enter into the constitution than what is rendered soluble by its combination with acid in the stomach. Too large doses of magnesia, however, are mischievous in another way, by causing the formation of magnesian *calculi* in the intestines. These are composed of magnesia mechanically blended with the *fæces* and intestinal *mucus.* They are not uncommon in these times, when so many individuals are in the habit of taking magnesia in a careless and profuse manner. I have, in several instances, known a person to suffer a good deal of distress from such a *calculus* being lodged in the *rectum.* But cases have occurred, in which the accumulation of magnesia in the intestine has taken place to a very great extent. Mr. WILSON examined the body of a patient, in whom, if I recollect rightly, many pounds of magnesia were found collected in the *colon*, above a contracted part of the *rectum.* In the exhibition of alkaline remedies, then, you must make each case the subject of a distinct experiment. * * * You should be provided with paper coloured blue by an infusion of litmus, and also with the same paper, slightly reddened by immersion in a very weak acid. Healthy urine ought to turn the blue litmus paper red; and you should avoid giving alkaline remedies in such a dose as to destroy this property altogether; still less ought you to render the urine alkaline. If the urine turns the paper blue, the patient is in danger of suffering from a deposition of the phosphates and the alkalies must be given in smaller quantity."—(pp. 202, 203.)]

(*a*) Above cited, p. 73.

(*b*) WOEHLER, p. 315.

(*c*) Above cited, p. 193.

(*d*) Medical Transactions, vol. vi. p. 212.

The following are the excellent remarks of PROUT on "the treatment to be adopted in what is usually denominated a fit of the gravel.

"*A Fit of the Gravel* consists in the secretion of a large portion of lithic (uric) acid by the kidney, under the circumstances above mentioned, and is usually preceded, as well as accompanied, by much constitutional derangement, with tendency to fever and inflammation. The principles of the treatment to be adopted in this form of the disease closely resemble those recommended in gravel, except that they must be more active. When the attack is acute, venesection or cupping from the region of the kidney, with active doses of calomel and antimonial powder (or omitting the latter, if *nausea* be present, and substituting opium or *hyoscyamus*) should be immediately had recourse to, and *precede the use of diuretic remedies.*—[*Note.*—I have seen great mischief done by the incautious use of stimulating diuretics at the commencement of the attack. The sufferings of the patient have been all aggravated, and his life has been placed in extreme danger.]—When these have begun to operate sensibly upon the system, though, perhaps, before the purgatives have produced actual stools, the patient may have recourse to warm fomentations about the region of the kidneys—or, what is much better, the warm bath, and commence the use of the diuretic purgatives formerly mentioned, with the addition of *colchicum:* and these means, if judiciously and vigorously applied, seldom fail of removing the inflammatory or spasmodic action of the kidney, and of producing a flow of urine. If the attack has been taken in time, the formation of a *calculus* in the kidney will thus be certainly prevented; or, at least, what is formed will be very small, and scarcely ever fail to be brought away without producing those distressing symptoms which usually accompany the descent of a *calculus* down the ureter. It need scarcely be mentioned, that a strict antiphlogistic regimen is to be adopted; and that the collateral and subsequent treatment must be regulated by the symptoms present." (pp. 151, 52.)

JONES, speaking of the treatment of the uric acid *diathesis*, in correspondence with LIEBIG'S views, observes, that "exercise which produces perspiration is the most beneficial; and this the more so, the colder the air is, because thereby a greater amount of oxygen is absorbed;" but it should be taken, "always stopping short of great fatigue, which might depress the vital powers, so as to admit of the production of an excess of uric acid." * * * Sleep, tending as it does to render the respirations as light and as few as possible, should be indulged in only as far as is necessary to repair the fatigue which exercise has produced. Hot rooms should be avoided. * * * Nitrous oxide water, known also as oxygenated water, is the best diluent in these complaints. Soda water very rarely contains any alkali, but consists of ordinary water with carbonic acid forced into it; so that, except for the quantity of water, it is in no way beneficial; and in this respect it is not so good as ordinary fountain water, inasmuch as the atmospheric air suspended in the latter is better than the carbonic acid in the former. * * * By the various preparations of iron we may also increase the amount of red particles in the blood, and thus influence the quantity of oxygen which is absorbed. Perhaps the greatest practical benefit has been derived from the sesquioxide of iron." It should "not be given in the enormous doses recommended, by which the whole intestinal canal becomes loaded; but in moderate doses, and in such a state as we know offers the least impediment to its absorption; that is, in the minutest state of subdivision. To effect this, it should be given newly precipitated from some soluble salt of iron; as, for example, from the sesquichloride or persulphate of iron, from which hydrated peroxide of iron may be formed by the addition of carbonate of ammonia or soda." (p. 34–6.)

"With regard to the treatment by diminishing the non-nitrogenous principles in the blood," JONES observes:—"It has been shown that the substances which contain no nitrogen, by combining with the oxygen which has been inspired, hinder the action on the uric acid; and it is highly probable, that no albumen undergoes metamorphosis until it has served the purposes of life. These are the first principles by which the practice must be governed; and hence, by far the most beneficial diet is a moderate quantity of meat, with a much smaller quantity of bread. The kind and quantities of both must be regulated by experiment and consideration of the habit and exercise of the patient. The quantity of starch in flour, as compared with animal food, renders it unsuitable to live only on bread. Meat alone would be far more beneficial. * * * Sugar and starch comprehend much the largest part of those substances in vegetables which can be absorbed; nitrogenous and oleaginous substances are present generally in small quantities, though the relative amount of these principles varies much in different species. Thus potatoes and rice are those in which most starch is found, and these are therefore most inadmissible; whilst in greens and peas there is much nitrogenous matter, which in peas is similar to cheese. Fruits usually contain large quantities of starch and sugar ; on this account, apples and pears are most objectionable. * * * Among non-nitrogenous substances fat must be included. If the formula for this is taken, as C 11, H 10, O, then 31 equivalents of oxygen are required, in order to convert this into carbonic acid and water ; and by taking this substance as food, so much oxygen is prevented from acting on the uric acid. Butter is only the fatty particles of milk, separated from the albuminous and watery parts ; this must on no account be taken in excess. Gelatine may be used as a partial substitute for meat ; but as the albuminous tissues cannot be formed from it, it cannot be entirely substituted for it without the strength failing.

" For drink the oxygenated water has been mentioned as best ; then water which has been distilled, and therefore contains no substances whatever in solution, and on this account it is, generally speaking, the best solvent ; that is, it can hold more in solution, and remove more from the body than another water which, when drunk, already contains substances dissolved in it. But this cannot be procured everywhere, and, therefore, it is desirable to point out how the best drinking water can be obtained." Filtering, or boiling water, or getting rid of the free carbonic acid gas by adding a little more lime, according to Reid's plan, are inefficient, and neither of the latter " causes any other salts of lime which may be dissolved in the water to be precipitated. To effect this, a few grains of carbonate of potash or soda should be added to the water before boiling, and the boiling should be continued for some minutes. By this means these salts of lime will be decomposed, and sulphate of potash and soda, or chloride of potassium and sodium, in very small quantities, will exist in the water after it has been filtered, or the chalky sediment has been allowed to settle to the bottom. Good fountain water or soda water are far better than beer and wine, which are objectionable for the spirit and sugar which they contain. The spirit is a substance which may be represented by C 4, H 6, O, and the sugar by C 12, H 14, O 14, the first requiring 12 equivalents of oxygen, and the last 24, to convert them into carbonic acid and water. The excess of sugar and acid in home-made wines renders them more injurious than foreign wines or spirits, of which gin and whisky most certainly also retard oxygenation, yet, by producing an excess of water in the urine, they cause that deposit which arises from the want of action of the oxygen to be dissolved, and thus the evil which they and other substances occasion is for a time concealed. (p. 37–41.)

" We can also diminish these non-nitrogenous bodies in the blood by aperients, which act on the liver. These will be found more particularly useful when the deposit is dark-coloured ; indeed, the deeper the colour the less action there is of the liver. * * * Of such medicines calomel, aloes, colchicum, and colocynth are beneficial, both in large and purgative doses, and also when given in such a way as to increase the secretion of the liver. Hence the efficacy of blue pill as an alterative. * * * The use of these medicines as purgatives must be judged of by their effects and the strength of the patient. * * * Sudorifics are occasionally given with great advantage. * * * With regard to baths generally their action may be considered to be on the nerves and on the blood, and on each the action is of two kinds ; thus on the nerves there may be a stimulant or sedative action, and on the blood they are capable of removing substances from it, and of enabling them to be absorbed into it. These modes of action depend on the state of the system, the temperature, and the substances which are dissolved in the bath. (pp. 41, 2.)

" The next point in the treatment that must be attended to is to keep all the uric acid in the ultimate textures in solution. This may perhaps be effected by water and alkalies. When these or their carbonates are given, they should be taken at least an hour before food in order that they may not interfere with digestion ; but though these medicines may relieve the complaint, they never can cure it. * * * I believe these medicines are the least necessary part of the treatment I have laid down, and it would be well for all to try what may be effected by diet and exercise, before they resort to alkalies, which may in some cases, perhaps, be the cause of an increase in the quantity of uric acid. This appears to be the opinion of Pelouze, in his last report." (p. 45.)]

2013. Gravel which is formed of *cystic oxide* requires the same *treatment* as uric acid, especially in reference to dietetics (1). In oxalate of lime gravel all vegetable food should be withheld, according to Magendie, but according to Prout the *treatment* must agree with that for uric acid gravel. After what has been already said (*par.* 1993) of the origin of gravel from oxalate of lime, both modes of treatment may be proper (2). In phosphate of lime gravel the increased constitutional irritability in general, and that of the urinary organs in particular, must be diminished by opium, by *hyoscyamus*, and the like, in combination with tonic remedies. At the same time acids, especially the hydrochloric, must be used, and if that cannot be borne, citric or carbonic acid. Much drinking, which is usually recommended to favour the solution of the phosphates, is in reality hurtful, and increases the already too great irritability of the kidneys and bladder. In the use of acids, however, it must be remembered that if the patient use more than is necessary for neutralizing the alkaline condition of the urine, and for dissolving the earthy salts which are deposited, the white gravel indeed disappears, but, in its stead, uric acid gravel is formed from the precipitation of the uric acid, in consequence of the acid state of the urine. The bowels should be kept open with gentle, but not saline medicines; the living should be strictly attended to: the patient should take easily digestible meat, light puddings, which seem more proper than the use of vegetables, and food destitute of azote, although, according to MAGENDIE and CHEVREUIL, the phosphates are diminished in the urine of *carnivora* by such diet. If any organic disease of the urinary passages or of the spinal marrow accompany phosphatic gravel, a proper treatment should be had recourse to.

[(1) With regard to the medical treatment of the sediment from cystic oxide, PROUT observes, that it "will depend on circumstances. In the first place, great care should be paid to the digestive functions, and if the urine be acid, the alkalies may be taken with advantage; on the contrary, if alkaline, the muriatic acid, indeed the latter, if the irritation present would permit it, might, perhaps, in all cases be employed advantageously, not only with the view of retaining the cystic oxide in solution, but of inducing the lithic (uric) acid *diathesis*. From the diseased state of the kidney, also, with which this *diathesis* seems to be so frequently associated, local counter-*stimuli* will be likely to be serviceable." (p. 169.)

(2) "The absence of urinary sediment, &c.," in the oxalate of lime *diathesis*, says PROUT, "are of a negative character, and lead to no inference where other circumstances are wanting, as is most generally the case. But if there be pain in the region of the kidney, and other symptoms of gravel, without any appearance of sediment, and if the urine be acid and of the yellow tinge above alluded to, the stomach deranged, and an inflammatory *diathesis*, either general or local, (*i. e.* about the urinary organs,) be present, and if all these are associated with suppressed gout, or tendency to cutaneous disease, the existence of this form of the disease may be suspected, and means immediately taken to counteract it. Besides the general principles of treatment above mentioned, I have lately adopted another principle, very different indeed from these, but which I think I have seen of considerable utility in two or three instances. This has been to endeavour to *change the diathesis from that of the oxalate of lime to the lithic acid*. It struck me that, as these two *diatheses* never appear to exist at the same time, if the former could be converted into the latter, that a very obscure disease would thus at least be exchanged for one of a more open character. The muriatic (hydrochloric) acid was chosen to effect this purpose, (though in some instances it is probable that the vegetable acids would answer as well,) and its use was continued till the lithic (uric) acid began to be deposited plentifully on the cooling of the urine. The muriatic (hydrochloric) acid is sometimes apt at first to derange the stomach, but notwithstanding this, in the few instances in which I have had an opportunity of adopting this plan, it has been always ultimately followed with very considerable relief to the patient's sufferings, both constitutional and local. * * * It need scarcely be mentioned that this plan of treatment requires some judgment and care in its management, and that it should hardly in any case be adopted when disorganization or *calculus* is already supposed to exist in the kidney or bladder, or perhaps in very young or very old subjects." (p. 160–62.)

"In the oxalic acid diathesis," observes JONES, "the oxydizing process is carried a step further than it is when the uric acid *diathesis* exists; but it is still stopped short of the extent to which it is carried in the state of health. * * * It is possible that sugar and perhaps other substances of the non-nitrogenous class, may, by imperfectly combining with oxygen in the body, give rise to oxalic acid; still the oxygen has evidently a much stronger affinity for the non-nitrogenous than for the nitrogenous substances in the body, and thus the process of oxydation is far more frequently incomplete in the latter than in the former; so that we should expect oxalic acid generally to arise from the insufficient oxidation of the uric acid, and much more rarely from sugar; and the alternation of this substance with uric acid in *calculi*, and the ease with which it is formed from uric acid, leads to the belief that this is the usual origin of oxalic acid. The free oxalic acid passing off by the kidneys, meeting with the phosphate of lime, which is secreted both by them and by the mucous membrane of the urinary passages, decomposes it, and oxalate of lime is the result. The same thing happens when oxalic acid is taken, as such, in the food; if free, like tartaric acid, it passes off at the kidneys, and combines with the lime which it afterwards meets with. If taken in combination with alkalies, like tartaric acid, it would probably be decomposed. The causes, then, of this disease are in most cases similar to the causes of the uric acid *diathesis;* both diseases may be referred to insufficient oxidation, and the treatment must consequently be the same in both." (p. 71–3.)

"It is highly probable that an excess of lime in the system may induce the formation of oxalic acid, but some lime is necessary for the bones and the membranes, and it is taken into the system in all solid and liquid food. Now, though it is impossible to obtain food absolutely free from it, and thus to hinder all formation of fresh oxalate of lime, still by rendering it as free as possible, the rapid increase of a *calculus* may be prevented. Perhaps of all substances, water is the easiest to render pure, and it is that which usually contains most lime. On this account, in the oxalic acid *diathesis*, distilled water should always be used in everything for which common water is employed in the state of health. When distilled water cannot be obtained rain water would be the best substitute; and when this is not to be had, then that which has been purified as already mentioned. * * * This treatment is merely palliative, and the curative treatment must be directed to the oxalic acid and not to the lime." (p. 74.)

(3) "The principles of treatment in both forms of the phosphatic deposit are," says **Prout**, "the same, and differ only in degree. The particular indications of cure seem to be to diminish the unnatural irritability of the system, and to restore the state of the general health, and particularly of the urinary organs, by tonics, and other appropriate remedies. In severe affections, especially of the amorphous class, *opium*, as far as my experience has hitherto extended, is the only remedy that can be employed with much advantage to fulfil the first indication. This must be given in large and repeated doses, such as from gr. i. to gr. v., or more, two or three times a day. Under this plan the more distressing symptoms will commonly be speedily relieved; and now, in conjunction with opium, (in more moderate doses if the state of the disease will permit,) the mineral acids, *cinchona*, *uva ursi*, different preparations of iron and other tonics may be had recourse to; or if the mineral acid should disagree, the citric acid may be taken instead. There may be also applied to the region of the loins, a large pitch, soap, or *galbanum* plaster, which frequently seems to afford considerable relief to the distressing pain there felt; or if the symptoms are unusually severe, and connected with manifest local injury, setons, or issues, may be instituted in the back. * * * The bowels are most frequently constipated; but purgatives of the more active class must be given with caution. Saline purgatives, more especially those containing a vegetable acid, as the Rochelle salts, the Seidlitz powders, &c., must be avoided, and recourse had to small doses of castor oil or laxative injections. Mercury, in all its forms, and particularly when pushed so far as to produce its specific effects on the constitution, seems capable of doing a great deal of mischief, when the phosphates are concerned, more especially in the severer forms of the affection; and if from other causes it be judged proper or necessary, as the least of two evils, to administer this remedy, its exhibition must be managed with caution, and its effects closely watched. Perhaps the best mode of exhibiting it in such cases is to combine it with opium, or with a purgative, in some instances. I cannot help thinking, however, that in very severe forms of the affection, its use had better be omitted altogether, till the more distressing symptoms have somewhat yielded, and the patient has recovered a little strength. Alkaline remedies of every description must be most carefully avoided, their use, in every point of view, being most mischievous, when the phosphates are concerned. Indeed, all remedies that act as diuretics, should, in general, be shunned, and the patient should be prohibited from drinking too much. With respect to drinks in general, they should be of a soothing demulcent character, and prepared with distilled or the softest water that can be procured, as hard waters are literally poison in this form of disease. In less severe cases,

where the source of irritation is chiefly confined to the urinary organs, and where the constitution is sound, and the strength not remarkably reduced, similar means may be had recourse to: though *opium*, to the above extent, is seldom necessary or proper. In such cases, the *hyoscyamus* is an excellent remedy, especially when combined with the extract of *uva ursi;* and more or less, according to circumstances, of the *extr. opii;* the same is true of the *alchemilla arvensis*, a strong infusion of which taken frequently, sometimes gives great relief. In such cases, also, occasional purgatives, especially of the milder class, may be employed with safety and advantage. (p. 182–86.)

"The *diet* in severe cases should be of the mildest and most nutritious kind, and taken in very moderate quantities at a time. From what I have seen I am certainly inclined to advise an animal diet in preference to an acescent vegetable diet, commonly recommended; but I wish it to be understood that no positive directions are given on this point; * * * for I am disposed to believe, that in all instances, that diet is most proper for a patient, which agrees best with him, and which, in many instances can be only known by actual trial; I may give it, however, as my opinion, that all watery diet, as soups, &c., should be taken very moderately. If the patient has been accustomed to wine, the Rhine or some of the lighter varieties of French wines will be preferable. Cider and perry may be also taken, if they do not disagree. I wish it to be understood, however, that the use of these is not particularly recommended. But these and everything else that can be done for a patient in this state, are of very little use, if the mind cannot be set at rest. The influence of mental anxiety is really astonishing in this disease; and absence from care, the exhilarating air of the country, and such exercises as are consistent with the patient's condition, will, perhaps, more than any thing else, contribute to the cure, particularly in the slighter cases, and when the cause is not local injury." (pp. 186, 87.) JONES observes that, in the palliative treatment of these complaints, "the first object must be to cause the phosphates to be retained in solution: this is effected by rendering the urine acid, which is most easily done by any vegetable acid, as tartaric, citric, acetic acids. It was found by the experiments of WOEHLER, on men and dogs, that if any of these acids are taken in a free state, that is not in combination with an alkali, they pass through the blood unchanged, and appear as acids in the urine. Why they should not be oxidized, as they are when in combination with alkalies, is at present unknown. * * * The dose of these acids should be gradually increased till the urine becomes again acid to test paper, when great care must be taken not to render it so much so as to cause precipitation of uric acid. * * * It has also been found, by experiment (*a*), that the strong mineral acids possess no power to render the urine acid; probably their strong affinity for the soda in the blood causes it to leave its combination with the albumen; and thereby salts of soda would be formed, and the acids would pass off by the kidneys as neutral salts. * * * Our chief attention must be directed to the removal, if possible, of the cause of the alkalescence which constitutes the curative treatment; this may be most beneficially joined with palliative measures. If the alkalescence arises from the altered mucus thrown out by an inflamed bladder, when the inflammation is cured, the acidity will return, the deposit cease. If the irritation of a stone causes the secretion of *mucus* or hinders the emptying of the bladder, the stone must be removed. If the alkalescence proceeds from weakness, it is only by restoring the general health that the urine will permanently regain its natural condition; though for a time, and for a time only, much evil may be hindered by the use of vegetable acids." (p. 86–8.)]

II.—OF STONE IN THE KIDNEYS.

(*Calculus Renalis*, Lat.; *Nierenstein*, Germ.; *Calcul Rénal*, Fr.)

HEVIN, Recherches historiques et critiques sur la Nephrotomie; in Mém. de l'Acad. de Chirurgie, vol. iii. p. 238.

TROJA, Ueber die Krankheiten der Nieren und der übrigen Harnorgane. Leipzig, 1788.

COMBAIRE, J. N., Dissertat. sur l'Extirpation des Reins. Paris, 1804. 4to.

EARLE, HENRY, On Renal Calculi; in Med.-Chir. Trans., vol. xi. p. 211–18.

2014. In the *calices* and *pelvis* of the kidney, stones may be formed of different shape and nature, singly, crowded together, or as one very large

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(*a*) BERZELIUS's Handbook, p. 467.

mass, distending the cavities of the organ, in which case, the substance of the kidney is diminished by absorption. The chemical nature of renal stones varies; they most frequently, however, are composed of uric acid.

[In rare cases, a stone in the kidney, if very large, may be felt through the loins. A case of this kind occurred to the elder CLINE, who would have operated, had the patient's health permitted (*a*).

PROUT accounts for the formation of uric acid stones in the kidney in the following way:—"The kidney is made up of a congeries of similar parts, or little kidneys, if we may use the expression, each one of which is independent of the others in its structure, and may therefore, probably, independently of the others, become more or less deranged in its functions. Let us suppose one or more of these little kidneys similarly deranged to the others, but in a greater degree, so as to secrete very little water, but a large proportion of lithic (uric) acid. In such a case, the lithic (uric) acid must be obviously separated in that peculiar semifluid condition, or state of hydrate, which it is well known to be readily capable of assuming. In this state it is bulky, and may thus occupy the whole of the *infundibulum* in which it has been deposited; or the quantity may be supposed to be sometimes so great as to be partly protruded, in a similar state, into the common receptacle or *pelvis* of the kidney. After remaining in this state for a greater or less time, crystallization may be supposed to take place; the semifluid mass will now be much diminished in bulk, and perhaps reduced to the form of a congeries of crystals easily separable from one another, and thus pass off in the form of gravel; or what may easily be supposed to take place, (especially when the lithic acid is very impure, and combined with a larger portion of the other matters than usual,) it may assume the form of an imperfectly crystallized or amorphous mass, and thus constitute a *nucleus* possessing these characters: or something between the two extremes may take place—the plastic mass may separate partly into crystals, and partly remain an amorphous mass, enveloping these crystals; in which case, a mixed kind of nucleus will be formed." (pp. 207, 208.)

BRODIE (*b*) observes, that uric acid stones occur "most frequently in those who have led luxurious and indolent lives; and who previously have been subject to deposits of lithate of ammonia, or of lithic acid sand, in the urine. It is this class of individuals that is especially liable to gout, and there is an evident connexion between these two diseases. A patient may have been in the habit of voiding lithic (uric) acid *calculi;* he becomes affected with the gout, and the formation of the *calculi* ceases. In a few cases the two diseases go on together. Some persons void a great number of this kind of lithic acid *calculi*. I am almost afraid to say how many I have known to be voided by one individual—probably some hundreds, of all varieties of size." (pp. 224, 25.)

"I have had fewer opportunities of examining renal *calculi* composed of oxalate of lime," says PROUT, "from their being comparatively more rare. Sometimes they are formed on a primary *nucleus* of lithic (uric) acid. In one or two instances, I have seen them contain in their centre an irregular cavity, formed apparently by the agglutination of several imperfectly globular-shaped plastic masses round a substance which had subsequently been entirely removed, or had disappeared by drying; the whole being afterwards surrounded by concentric *laminæ* of the same substance. It may, perhaps, appear difficult to conceive how a substance so insoluble as oxalate of lime can exist in a plastic state, or form a *calculus* at all; since, in our hands, this salt occurs only in the state of a powder, and seems incapable of concreting or assuming the crystallized form. Perhaps the circumstance may admit of an explanation, by supposing that a solution of oxalic acid, nearly in a saturated state, and in union with a little lime, is secreted by a portion of one of the kidneys, instead of the lithic (uric) acid in the former case; that this, enveloped in the usual animal matters, passes from the *infundibulum* into the *pelvis* of the kidney, and there meeting with the lime naturally contained in the urine secreted by the other parts of the kidney, instantly combines with it, and forms the compound in question; and that from the peculiar manner in which it is formed, and the abundance of animal matters present, it may be able to exist for some time at the temperature of the human body in a plastic semifluid state, before the whole concretes into a solid mass. Whether this supposition be admitted or not, which is a matter of no importance, the facts are certain, that oxalate of lime not only does sometimes exist as an amorphous mass in renal *calculi*, but occasionally in the form of crystals also; a circumstance still more difficult to explain, except on some such supposition as the above." (pp. 209, 210.)

BRODIE also observes:—"*Calculi* of oxalate of lime are much more rare than those of lithic (uric) acid. It is not merely that the disposition to form them exists

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(*a*) A. COOPER's Lectures, vol. ii. p. 222.

(*b*) Above cited.

in fewer individuals, but that where it does exist they are not generated in the same number as the lithic (uric) acid *calculi*. A patient may void one of these *calculi*, and never void another, or he may void a second after the lapse of many years. In one instance, however, in examining a body after death, I discovered as many as five or six in one kidney: extensive suppuration and complete disorganization of the glandular structure of the kidney; and this local disease was the immediate cause of death." (p. 225.)

"*Calculi* of cystic oxide," PROUT states, "are extremely rare. From what has been already quoted on this subject, there is reason to conclude that they generally originate in the kidneys. I have only had an opportunity of examining two specimens of this species of *calculi*, with reference to their primary *nuclei*; in one of these the *nucleus* consisted of a small triangular amorphous mass, apparently of the same matter as the rest of the *calculus*, though a little deeper coloured. In the other, no distinct *nucleus* could be discovered." (p. 210.)

The rarity of renal stones composed of the phosphates, PROUT considers as depending "on various circumstances. In the first place, this form of the disease is seldom original, but consequent to others; and the system appears to be affected *generally*, rather than the kidney locally, as in the other forms of the disease. In the second place, the large flow of urine, and the consequent hurried state of action to which the kidneys are necessarily subject, may be justly considered as unfavourable to the formation of renal *calculi*. In some instances, however, as before stated, *calculi* composed of the phosphates are actually formed in the kidney; but in every instance of this description, the particulars of which I can trace, it has occurred only in very severe and obstinate cases of the phosphatic *diathesis*." (p. 211.)]

2015. The *diagnosis* of renal stones is for the most part doubtful, as the symptoms which they produce are very various. Sometimes they cause no pain; often the patient feels an oppressive, dull, straining pain in the region of the kidney, which sometimes ceases and then recurs, is diminished by rest, and increased by jolting movements of the body. With pointed, angular stones, the pain is severe and tearing, extending towards the groins and testicles. Not unfrequently inflammation of the kidneys occurs with all its symptoms. The urine is often mixed with blood, *mucus*, pus, and sand.

["Sometimes," says BRODIE, "*calculus* in the kidney may be said to cause no inconvenience at all, so that *calculi* are found in the kidney after death, the existence of which had never been suspected during the patient's lifetime. In other cases, the patient complains of pain in the loins, and the urine is occasionally tinged with blood, especially after any jolting exercise, such as riding on horseback." (p. 233.)

ASTLEY COOPER observes, that "the presence of a stone in the kidney is sometimes manifested by extreme irritability of the bladder," of which he mentions an instance, in a male, that had existed for a great length of time without being relieved by treatment. After death, "no disease of the bladder or *urethra* was found, but a large stone was discovered in the kidney." (p. 221.) BRODIE relates a similar example in a female, but in this case, "the urine deposited what appeared at first to be a muco-purulent secretion, but afterwards had all the characters of true pus, like that from an abscess." After two or three years, symptoms of a stone passing through the ureter came on; a large stone was voided by the *urethra*, and the original symptoms were relieved. (p. 68.)]

2016. Stone in the kidney is a tedious and painful disease. If only one kidney be affected, there is less danger to life than if stone exist in both kidneys. If inflammation of the kidneys arise, it may cause death by its severity, and by the complete suppression of the urine, or it may go on to suppuration, and the pus may be discharged either by the ureter, or it may form a fluctuating tumour in the loins.

["In the majority of cases," says BRODIE, "a *calculus* of the kidney finds its way into the bladder soon after its first formation; but in other cases it remains for a considerable time in the kidney, being at last dislodged by some accidental circumstance;" of which he mentions a good example, of a gentleman whose urine had been occasionally tinged with blood; having been overturned in a carriage, he soon after found himself unable to make water, but after some straining, a renal *calculus*, which seemed to have the form of one of the *infundibula* of the kidney, was projected with no small degree of force, and the urine flowed in a full stream." (p. 233.)

Instances of abscesses in the loins, by which stones from the kidney have been either extracted or discharged, are mentioned by HEVIN (*a*), and by ASTLEY COOPER, in whose patient they were composed of the ammonia-magnesian phosphate (*b*). BRODIE also mentions the case of a woman who had abscess in the loin, which after death was found communicating with a large collection of irregular-shaped stones in the kidney (*c*).

A stone remaining in the kidney may be snapped in two by the person making use of any unaccustomed exertion, of which my friend CRISP has mentioned to me the following example:—A medical man whilst jumping over a flower bed, dropped down suddenly with intense pain in the loin, which continued for two or three hours. He died a few months after of heart disease and other lesions, and on examination of his body, a stone was found in the kidney of irregular oblong form, which was separated transversely into two nearly equal halves.—J. F. S.]

2017. The *treatment*, when the object is the solution of the renal stone, or the getting rid of the disposition to *lithogenesis*, must be guided by the rules already laid down (*par.* 2011–13.) It is in general confined only to lessening the symptoms, by blood-letting, mild mucilaginous drinks, antispasmodic remedies, baths, rubbings and the like (1).

The removal of the stone *by cutting (Nephrotomia)* can only be undertaken, when an œdematous, or fluctuating swelling, or a fistula has formed in the loins. Having opened the abscess, its bottom must be examined with the finger or the probe, and if a stone be met with it must be removed, after enlarging the wound, if it be too confined. If there be a fistula leading down to a stone, it must be properly enlarged with sponge tent or with a bistoury. If the stone be fixed, its extraction must be postponed till it has become somewhat loose. Oftentimes a superficial suppurating cavity is found between the muscles and the skin, from which an opening leads to the abscess in the kidney. The wound, whether or not a stone be found, should be kept open with wads of lint attached to a thread, as long as stones are formed in the kidney, or the diseased secretion exists in the urine (2).

[(1) "If there be symptoms," says BRODIE, "which lead you to suspect that a stone is lodged in the kidney, it is of course desirable that it should be made, if possible, to pass into the ureter, before it has attained such a size as to be incapable of being conveyed along the canal into the bladder. Horse exercise, especially hard trotting, in such a case generally produces bloody urine. This shows that the *calculus* is made to undergo some change of position, and whatever produces this effect, is, of course, favourable to its escape from the kidney.—[With due respect to this high authority, I should hesitate in advising horse exercise, or any other violent effort to excite change of place in the stone, for fear of setting up active inflammation in the kidney, already irritated by the pressure of stone, and which might not be very easily or certainly repressed.—J. F. S.]—It is reasonable to suppose, that medicines which occasion a more abundant flow of urine, combined with diluting drinks, may also be useful under these circumstances. Where a *calculus* retained in the kidney produces considerable pain in the loins and neighbouring parts, the patient will sometimes derive benefit from local blood-letting, by cupping, or by leeches. At other times the application of the *belladonna* plaster. You may also employ setons and issues in the loins, as recommended by EARLE (*d*). According to my experience, however, the last-mentioned remedies are seldom very useful, except in those cases in which disease of the kidneys, and especially abscess of the kidney, has taken place as a consequence of the lodgment of the *calculus*. That they are sometimes eminently useful, under these last-named circumstances, I cannot doubt." (p. 241.)

"When the inflammation of the kidneys is supposed to be connected with the presence of renal *calculi*," which is by far the most frequent occurrence, PROUT recommends, "in connexion with general blood-letting or cupping (if necessary) and the warm

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(*a*) Mém. de l'Acad. de Chirurgie, vol. iii. p. 266.

(*b*) Lectures, vol. ii. p. 222.

(*c*) Above cited, p. 69.

(*d*) Med.-Chir. Trans., vol. xi. p. 211.

bath, calomel in active doses, which, when the constitution is otherwise sound, may be employed with great advantage, especially if it be immediately followed or accompanied by the use of *hyoscyamus* in pretty large doses, so as to ensure the anti-spasmodic effects of the latter on the system; and when the urine is high-coloured and acid, the purgative effects of the calomel may be increased or kept up by the use of some of the diuretic purgatives, such as the neutral salts, and particularly the tartarized soda. This plan may be pursued for a greater or less time, according to the circumstances of the patient; and will, in favourable cases, be followed by the expulsion of the *calculus* from the kidney, without the severe symptoms commonly accompanying its descent down the ureter." (pp. 219, 20.)

(2) In connexion with the subject of stone in the kidney, the following observations of Brodie on what he considers to be

Gouty Inflammation of the Kidney are worthy of particular notice. "A class of cases you will occasionally meet with," says he, "among the affluent classes of society, the symptoms of which bear no small resemblance to those just described, although they have a very different origin; and the *diagnosis* of which is of no small importance in practice. The persons liable to be thus affected are those who lead indolent lives, indulging themselves, at the same time, in all the luxuries of the table. There is pain in the loins, often very severe, extending downwards to the groin; the urine is scanty and high coloured, depositing, as it cools, an abundant red or yellow sediment (lithate of ammonia.) So far the symptoms a good deal resemble those produced by the passage of a *calculus* down the ureter; but the absence or pain in the testicle, of sickness and faintness, and the presence of no small degree of symptomatic fever, enable you to distinguish the two orders of cases from each other. The effect produced by the remedies will assist you in your *diagnosis*. The symptoms which have been just described are of a gouty origin, and yield almost immediately to a free exhibition of *colchicum;* which, however, it is generally more prudent not to administer until after the bowels have been emptied, by the exhibition of some grains of calomel, followed by a draught of infusion of senna with the sulphate of magnesia, or some other saline aperient." (p. 232.)]

III.—OF STONE IN THE URETERS.

(*Calculus Uretericus*, Lat.; *Stein in den Harnleiter*, Germ.; *Calcul engagé dans l'uretère*, Fr.)

2018. When a stone descends from the kidney into the ureter, more or less violent symptoms arise, in proportion as the passage of the urine through the ureter is completely or partially prevented. Pain comes on which descends from the kidney to the *pelvis*, and the patient often feels distinctly the gradual progress of the stone. The ureter is often considerably distended by the urine collected above the stone. Symptoms of stone in the kidney will also have been previously observed. When the stone escapes from the ureter into the bladder, the symptoms quickly subside, and those of stone in the bladder arise (1).

The *treatment* is precisely similar to that for stone in the kidney, and for *ischuria ureterica* (2).

[(1) "The time occupied by the passage of the *calculus* along the ureter varies in different cases," says Brodie(*a*), "according to the dimensions and figure of the *calculus*, and the impulse which it receives from the current of urine behind it. Sometimes the *calculus* may reach the bladder almost immediately; at other times it may be lodged in the ureter for many hours, or even for two or three days. Where the passage of it is thus protracted, the parts to which the pain is sympathetically referred, become tender to the touch, and the testicle not unfrequently is actually inflamed and swollen, the inflammation of it continuing for some time after the cause which produced it had ceased to operate. * * * The pain is often very severe, and in that case attended with sickness and vomiting, prostration of strength, cold extremities, a feeble pulse, and a pallid countenance; in short the patient is what is commonly called in a state of collapse. These symptoms are followed by pain referred to the inside of the thighs and the testicle; and frequently the testicle is drawn upwards to the groin by a

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(*a*) Lectures in London Med. Gaz., vol. viii.

spasmodic contraction of the cremaster muscle; no relief is experienced until the *calculus* has escaped from the lower orifice of the ureter, and entered the bladder; but as soon as this has happened, the patient's tortures, for they truly deserve that appellation, are at an end. (p. 66.) It seldom happens that the excretory duct of the kidney is completely obstructed, but when it is so the necessary consequence is that the urine becomes accumulated in the *infundibula*, and that these become dilated to a large size, forming membranous cysts; while the glandular structure of the organ is expanded, and in a great measure absorbed from the pressure which is thus exercised upon it. In some cases, you find at last the kidney converted into a large membranous bag, on the surface of which scarcely a vestige of the glandular structure is perceptible, while the interior of it is composed of a number of cells communicating with each other, and all containing urine." (p. 68.)

"But a *calculus* (*a*) may be of such size as to be stopped in its passage to the bladder, and retained in the ureter. One might suppose, that under these circumstances, the ureter would become more and more dilated, and at last burst, as the *urethra* bursts behind a stricture. I cannot say this never happens; and indeed MORGAGNI quotes a case from another writer, in which there is reason to believe that such an event actually occurred. However, this is not the constant order of events, as the following case, which occurred to BRODIE, will prove; a person for several years had been subject to the formation of renal *calculi*, which were passed by the *urethra*. At last, however, an attack came on, no stone passed, and he ceased to void urine; a catheter was passed, but no urine flowed; the patient became comatose, and died ten or twelve days after." In one kidney there were several *calculi;* there were none in the other. In the latter and in the upper part of that canal, there was a *calculus*, as it were wedged in, of about the size of a horse bean. A patient died also under TRAVERS's care, with the same symptoms, having each ureter where it arises from the *pelvis* of the kidney completely obstructed by a *calculus*." (pp. 241, 42.)

Persons may also die from suppuration occurring in the kidney, whilst its escape is prevented by a stone blocking up the ureter. A case of this kind is related by ASTLEY COOPER (*b*) as having occurred to the elder CLINE; he had operated on a boy for stone in the bladder. "The boy had recovered from the operation, when he was seized with rigors, great pain in the course of the ureter, and vomiting; a swelling formed just above the seat of the *cæcum*, in the right iliac *fossa*, which gradually increased, and the boy's constitution quickly gave way. On *examination* after death, the *pelvis* of the kidney and the ureter were found distended with matter; and at the end of the ureter near the bladder, a stone was discovered, which had prevented the escape of the urine and matter into the bladder, and thus occasioned death." (p. 225.) He mentions also the case of a woman who "had great pain in her loins, and tenderness in her *abdomen*, with so much fever, that she did not live long. * * * Upon making an incision into the *abdomen*, there issued a strong urinous smell, and a watery fluid mixed with matter. The intestines were inflamed and adherent; the bladder was small; one kidney was much enlarged, and the other unaltered; the ureter of the enlarged kidney was greatly increased in size, and full of matter; it was completely closed at the lower part by a *calculus*, and had given way above, so as to allow of the escape of the urine and matter into the *abdomen*." (p. 226.) He also relates one case in which a stone stopped for some time in the ureter, and the latter having become adherent to the *colon*, ulceration ensued, and the stone was discharged by stool; and another where "an abscess formed near the anterior superior spinous process of the *ilium* from which a *calculus* and a quantity of matter were discharged, and the patient recovered." (p. 227.)

(2) As to treatment, ASTLEY COOPER recommends large bleeding, warm bath, opium, *liquor potassæ*, to allay irritation, and the *abdomen* to be fomented, and gently rubbed from above downwards to assist mechanically the passage of the *calculus*. (p. 227.)]

IV.—OF STONE IN THE BLADDER.

(*Calculus Vesicalis*, Lat.; *Harnblasenstein*, Germ.; *Calcule Vésical*, Fr.)

2019. Stone in the urinary bladder is either primarily formed in the kidney, and enlarges in the bladder, or it forms in the bladder, as in incrustations on foreign bodies. The variety of stone in the urinary bladder is very great, as regards shape, size, number, and position; and on these, in part, depends the severity of the symptoms which it excites.

(*a*) Lectures, at the head of this article.

(*b*) Lectures, vol. ii.

["Calculous disorders," observes Brodie, "prevail differently in different classes of society, among individuals of different ages, and in different climates and districts. Among the lower classes, children are much more liable to *calculi* than adult persons. You know how large a proportion of our hospital patients admitted for lithotomy are children. On the other hand, in private practice, that is, among the upper classes of society, very few of our patients are children, and the great majority are persons above fifty years of age. Nor are these things of difficult explanation. The great majority of *calculi* are originally composed of lithic (uric) acid, that is, have a lithic acid *nucleus*. * * * In all classes, persons of a middle age are less frequently affected by stone in the bladder than those who are younger or older." (p. 253.)

These observations are confirmed by the following analysis of three hundred and fifty-four cases, between the ages of two and of seventy-nine years, which has been given by Smith, of Bristol (*a*), together with the results of the operation, which was performed on all, seven only of the number being females, of whom two were under ten years, three between ten and twenty, one between twenty and thirty, and one between thirty and forty.

Analysis of 354 Cases of Lithotomy.

" 135	from 2	years to 10;	Cured, 106;	Died, 29,	or one death in 4½
65	10	20	52	13	5
35	20	30	30	5	7
34	30	40	27	7	5
37	40	50	26	11	3⅓
28	50	60	22	6	4⅔
18	60	70	11	7	2½
2	70	79	1	1	2
354			275	79	4½"

Smith estimates the number of stone-operations in the provinces at 90; in the London hospitals, at 47; and in London private practice, at 30; making a total of 167: in the whole of Scotland, at 12; in Ireland, the same; and that, if we take the whole in round numbers at 200, we shall have the very extreme point of calculous cases for our whole population. He also notices the curious fact, that certain districts abound in cases; whilst, in others, the disease is scarcely known. "Let us instance Norfolk and Hereford; and again, it is a surprising truth, that in the hospital at Norwich alone, the numbers are as great as either in all Ireland or Scotland." (p. 50–2.) Whilst in the County Hospital at Hereford there had not been a single stone-patient in the course of forty-five years. Sailors appear to be remarkably free from stone in the bladder, as from A. Copland Hutchinson's (*b*) account, only eight cases occurred in the course of fifteen years in the navy, during which period the average annual number of men in the service was 132,000. And he asks two questions—*first*, that it appearing "seamen, who have rarely opportunities of indulging in the use of malt liquors, are, in great measure, exempt from urinary concretions, whether all kinds of fermented liquors be not favourable to the production and accretion of such disorders?" *second*, "may it not, therefore, happen, in the instance of seafaring men, that the peculiarities of their regimen, and especially the great quantities of muriate of soda they habitually take with their food, contribute to produce this effect?" (p. 453.)]

2020. In regard to the form of stone in the urinary bladder, what has been already stated in general (*par.* 2005) applies here also. In most cases, especially when there is but a single stone, it is oval, and somewhat flattened on both sides; its surface smooth, bossed, or angular, and often with *facettes* of various forms (1). Its size usually varies between that of an almond and of a hen's egg; it may, however, be much larger (2). In general, there is only one stone in the bladder; but, sometimes, several, even as many as a hundred, exist at the same time (3). In such cases, the stones, as already remarked, are, in some places, smooth, ground away, and variously formed, by lying against

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(*a*) A Statistical Inquiry into the frequency of Stone in the Bladder in Great Britain and Ireland; in Med.-Chir. Trans., vol. xi. p. 1. 1820.

(*b*) On the Comparative Infrequency of Urinary Calculi among Seafaring People; in Med.-Chir. Trans., vol. ix. 1818.

each other. According to their chemical composition, they vary in reference to their firmness, colour, and the like. In most instances, the stone lies *loosely* at the bottom of the bladder; but not unfrequently it is attached at one place, which may occur in different ways. *First.* The stone sticks in the orifice of the ureter, or, in escaping from the ureter, it slips between the membranes of the bladder, and enlarges, so that it lies in a cavity of its own, which communicates with the bladder itself by a roundish opening. *Second.* It lies in a *diverticulum* of the bladder, or in a *hernia* of the bladder (4). *Third.* In many persons the inner surface of the bladder has a peculiar net-like disposition, by which fan-shaped hollows are formed; and if the formation of a stone begin in one of these, the hollow is gradually enlarged, and the stone is, for the most part, overspread by the internal coat of the bladder. In proportion as the stone increases, the enclosing membrane stretches, so that it is connected to the other part of the bladder merely by a neck (5). *Fourth.* Stones, which form in the prostate gland, may partially project into the bladder. *Fifth.* In consequence of the irritation of the stone, and the inflammation depending thereon, false membranes are formed by the exudation of plastic lymph, which partially cover the stone.

Stones which are enclosed and held fast in one of the above ways (*Calculi saccati*, Lat.; *Umschlossenen* und *festgehaltenen Steine*, Germ.; *Calculs enchatonnés*, Fr.) must be distinguished from the so-called *adherent stones*, (*Calculi adherentes*, Lat.; *Angewachsenen Steine*, Germ.; *Calculs adhérens*, Fr.,) a term which can only apply to those cases in which excrescences, *fungus*, and *polypi* of the bladder become incrusted (*a*).

[(1) In reference to those stones occasionally met with, and which being contracted in their middle, have somewhat the shape of an hour-glass, TAYLOR (*b*) observes:—"It has been conjectured that in such cases they have been partly lodged in the orifice of the ureter or in a pouch of the bladder, and that the growth of the *calculus* has continued unobstructed at the two extremities, while it has been prevented in the middle by the constriction of the orifice. But the deposition of crystals, even on the constricted portion, seems scarcely consistent with this explanation, unless it is conceived that they were deposited after the *calculus* had escaped into the cavity of the bladder." (p. 83.)

(2) The size of stones is very variable. The largest stone is, I believe, that from Sir WALTER OGILVIE, which is in the College Museum H 2, consisting of mixed phosphates; it weighs forty-four ounces, measures sixteen inches around its long axis, and fourteen around its short axis. Its origin seems to have been traced to his having received a blow in his back from the boom of a vessel, when twenty-three years of age; in consequence of which it was necessary to draw off his water with a catheter for two months; and for a twelvemonth after he was obliged to keep in bed, in a horizontal posture; his bladder, however, recovered its powers. Twenty years after, symptoms of stone having appeared, and sounding having led to the belief in the existence of a large stone, the operation was advised, but not assented to. He continued to become worse, and towards the latter end of his life he could "make no water, without standing almost on his head, so as to cause the upper part of his bladder to become the lower, and this he was obliged to do frequently, sometimes every ten minutes, as the quantity voided each time was less than the measure of a wine-glass. At last, however, thirty years after the accident, he was so worn out, he was determined to have the stone removed, which could now be felt above the *pubes*, forming a large prominent tumour, and below it prevented the entrance of a sound into the bladder. The operation was attempted by CLINE, but no kind of forceps could be introduced till a soft part of the stone having been found, some of it was broken away with the finger, and then the forceps broke away more, till,

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(*a*) HOUSTET, Observations sur les Pierres enkystées et adhérentes à la vessie; in Mém. de l'Acad. de Chirurgie, vol. i. p. 595.—DESCHAMPS, above cited, vol. i. p. 59–77.—WALTHER, above cited, p. 424.

(*b*) College Catalogue, part i.

with the aid of the scoop, about a teacupful of fragments was removed; but the greater part of the stone remaining hard and impenetrable, and Sir WALTER being much exhausted, the operation was given up: he died on the tenth day. The stone appeared moulded by the bladder; the lower part confined by the bony *pelvis*, with its impression, and was smaller than the upper part, which had projected so as to lie on the *pubes* (*a*).

Of stones which have been removed, ASTLEY COOPER mentions one in Trinity College, Cambridge, which weighs thirty-two ounces and seven drams; a cast in St. Thomas's Museum of one which weighed twenty-five ounces; another of sixteen ounces which he himself removed, but without success; one removed piecemeal, by MAYO (*b*), of Winchester, weighing fourteen ounces and two drams, and measuring eight inches and a half in its smallest, and ten in its largest diameter; one in the Museum of the Norfolk and Norwich Hospital, of eight ounces. The largest stone removed successfully by ASTLEY COOPER, weighed near six ounces. SMITH (*c*) mentions a cast in the Bristol Museum, of a stone which weighed ten ounces and a half, and measured nearly ten inches in circumference: the patient recovered in eleven weeks. In the Museum of the College there is a stone, A c 7, composed of three large uric acid stones, cemented together with mixed phosphates, which weighs seventeen ounces: it was removed by CHESELDEN, in St. Thomas's Hospital, from a man fifty years of age, but he died the next day after the operation.

As to the small size of stones, perhaps that of ten grains from a lad of thirteen years, and that of a few grains from a boy of sixteen, removed by MARTINEAU (*d*), may be considered among the smallest.

(3) "The greatest number of stones I ever extracted in the operation of lithotomy," says ASTLEY COOPER, "was one hundred and forty two, many of them about the size of marbles. A great number of stones does not add much to the patient's danger in the operation; for it is not the frequent introduction of the forceps, but the violence which is used in extracting the stone or stones which produces mischief; thus the removal of one large stone, is more to be dreaded than that of many small." (p. 233.)

(4) In the Museum of the College of Surgeons, there is a fusible stone which was removed by POTT (*e*), from a vesical rupture in a boy of thirteen. "When six years old he was seized with an acute pain about the region of the *pubes*, which lasted near an hour and a half, and suddenly ceasing he became easy. During the time his pain lasted he could not discharge a drop of water, though he endeavoured so to do, but as it ceased he pissed freely. In a few days after a small tumour was discovered, about the size of a pea, in the spermatic process just below the groin; it gave the child no pain, and therefore no notice was taken of it." When thirteen years old it became troublesome from its weight, though he had never any pain in his back and loins, and it was therefore determined to remove it. This was done by a cut through the skin and cellular membrane, the whole length of the process and *scrotum*, which exposed a firm white membranous bag or cyst, narrowing upwards, and being followed was found "dependent from and continuous with a membranous duct, about the breadth of the largest wheatstraw, or what it was more like to, a human ureter, which passed out from the *abdomen* through the opening in the muscle." On dividing this duct, immediately above the tumour, four ounces of a clear fluid issued, and the mouth of the cyst expanding, presented a stone similar to that found in the human bladder. To decide on the connexion of the cyst with the bladder, the boy was after some time directed to make water, when a large stream of urine flowed through the wound instead of by the *urethra*. He recovered. In the preparation the stone is enveloped in the cyst.

(5) The case related by BRODIE of "an elderly person, who for the most part suffered little inconvenience from the disease, but every now and then was suddenly seized with usual symptoms of stone and very severe ones too," seems to be of this kind, except, that it does not appear to have had any neck, which as far as I have had opportunity of seeing is very rare. He lived three or four years after the detection of the disease, and died of pleurisy. "On *examining* the body, I found," says BRODIE, "the stone embedded in a cyst near the *fundus* of the bladder. The cyst was formed in this case, not by the protrusion of the mucous membrane between the muscular fibres, but by a dilatation of both tunicles of the bladder, the muscular as well as the mucous. It was such a receptacle as would be supposed a large *calculus* which had long been resident in the bladder, might gradually have made for itself. The stone was not so closely embraced by the cyst as to prevent it occasionally slipping out of it, and I suspect that this actually hap

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(*a*) TAYLOR's Catalogue, part i. p. 116–19.

(*b*) Med.-Chir. Trans., vol. xi. p. 55. 1820.

(*c*) Ibid., p. 15.

(*d*) Med.-Chir. Trans., vol. xi. p. 407.

(*e*) Chirurgical Works, vol. iii. p. 324.

pened, and that it was when the stone lay in the cyst, that the patient was free from the usual symptoms of *calculus*, and that his sufferings took place when the stone escaped from it into the general cavity of the bladder." (pp. 258, 59.)

(6) **Wickham** (*a*) relates the case of a boy four years old, on whom he performed the lateral operation, and met with some difficulty in extracting the stone; "no untoward symptom occurred until about the eighth day, when the water returned to its accustomed course, which was attended by severe pain, the boy screaming very loudly at each effort to make water. This continued till the fourteenth day, the wound having appeared foul and the surrounding parts inflamed for two or three days previously, when a substance came away from the wound, having the following appearance. It is a cyst, apparently of the same structure as the bladder; its size is sufficient to contain the *calculus*, which weighed two drams; the opening into it is just large enough to admit of its exit, and its whole internal surface is lined with calculous matter, in fact, studded with large pieces of *calculi*. * * * I have no hesitation," says **Wickham**, "in pronouncing the substance voided by the wound to be a cyst, in which the stone was contained previous to the operation." (p. 186.) I cannot agree with **Wickham**'s conclusion on this point, as he states (in describing the operation) that "the stone being completely exposed, he passed in the forceps again, and took away the *calculus* without difficulty," though he had done nothing more than dilating the gorget wound, which he thought had not been made sufficiently large, by a very slight effort with his finger. I do not think the stone had been encysted, not even by a false membrane, as here described by **Chelius**, but it seems to me corresponding precisely to the following circumstance mentioned by **Brodie**:—"It occasionally happens, that coagulated lymph is effused from the inflamed mucous membrane of the bladder. The inflamed mucous membrane also secretes the adhesive *mucus* which contains the phosphate of lime. A portion of the phosphate of lime thus produced, mixed probably with some of the triple phosphate from the urine, is deposited on the lymph, and thus the incrustation takes place. It corresponds exactly to the incrustation of the wound of the *perinæum*, which occurs after lithotomy, where the operation is followed by the secretion of the same ropy *mucus* from the bladder." (p. 260.)

Brodie speaks of "a class of cases which, being of rare occurrence, do not seem, in the present state of our knowledge to be of much practical importance," and quotes from a letter of **Heister** (*b*), "the history of a patient who, having for a considerable time, laboured under the symptoms of stone in the bladder, began to void by the *urethra* what had all the appearance of portions of a larger *calculus*, broken down into fragments of various shapes and sizes. The number of these fragments at last amounted to more than two hundred, and now the discharge ceased, the symptoms at the same time having subsided, and the patient being restored to perfect health. In this instance, the discharge of the fragments of the *calculus* was attributed to the use of certain mineral waters." **Prout** mentions a case, in which, however, the same happened without the patient using mineral waters, or any kind of medicine; and **Cross** speaks of numerous fragments which he obtained from a gentleman after a ride on horseback; as well also "of twenty-two *calculi* removed after death, from a patient seventy years of age, which are of a very irregular shape, but admit of being so arranged as to form four regular and well-shaped *calculi*, each of the size of a pigeon's egg, which, with the appearance of the different surfaces, proves that the *calculi* had broken in the bladder by knocking against each other under certain movements of the body. The incrusted state of the fractured surfaces proves, that the *calculi* were broken some time before the death of the individual." (p. 10.) **Brodie**, himself, has also seen three cases of the same kind; in one, evident fragments of a larger *calculus* were voided by a young lady; in another, numerous small *calculi* were voided next day after a journey, which had the appearance of having been recently broken, probably from the concussion of them one against the other during the journey; and a third, in which after or whilst drinking some mineral waters, "he began to void with his urine broken pieces of *calculi* of various shapes and sizes, but generally with one concave surface, and rough irregular edges, as if the various *laminæ* of which the *calculi* were composed had cracked, and then had become separated from each other. After some time a great number of these fragments having come away, the discharge of them ceased, the patient, being at the same time, relieved from all the symptoms under which he had formerly laboured." (p. 269–71.)

In the Museum at the Royal College of Surgeons there are several examples of similar broken stones.]

2021. The symptoms of stone in the bladder are very various. In

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(*a*) London Medical Gazette, vol. iii. 1829. (*b*) Phil. Trans., vol. xxxvii. p. 13. 1731, 32.

general, when the stone is primarily formed in the kidney, there is more or less severe pain in the kidney, and running along the ureter. This is wanting if the stone be first formed in the bladder itself, and especially must not be considered as a certain and constant symptom. The patients have a sensation of warmth or painful tickling in the *glans penis*, and they, therefore, especially if children, are continually pulling the *penis* about and drawing it away from the body. These sensations show themselves at the beginning of the disease, but only when the patient exerts himself violently, or the posture of his body is suddenly changed, or immediately after passing the last drops of urine. The orifice of the *urethra* is inflamed, as in a clap. The call to make water occurs very frequently, and whilst the water flows, there is a burning pain at the tip of the *glans*. The stream of urine is often suddenly interrupted; the most insufferable pain occurs with severe forcing, and the urine only again begins to flow when the patient changes his posture, lies on his back or the like. The discharge of the last drop of urine is attended with the most violent pain, as the bladder then contracts upon the stone. The call to make water is accompanied with frequent forcing at stool, and often to such degree that the *rectum* protrudes, and frequently the hæmorrhoidal vessels swell from the irritation of the bowel. The same also occurs in women, with the *vagina*, which in a long continued state of irritation and inflammation, becomes the seat of constant mucous discharge, and often protrudes. The urine passed is generally pale, limpid, and has a peculiar offensive smell. If the patient keep quiet, the symptoms are usually slighter; but they increase on every movement, in walking, riding on horseback, or in a carriage, in which latter case the patient often feels as if a foreign body fell from one part of the bladder to another; after violent movements some drops of blood frequently flow from the *urethra*. The patient complains not unfrequently of a painful drawing up of the testicles, accompanied with numbness along the inside of the thigh, sometimes running down even to the foot. He also often feels a tormenting violent pain in the sole of the foot, sometimes a slight sensation of numbness, or a troublesome tickling. As the irritation of the stone on the walls of the bladder continues, they are brought into a state of slow inflammation, the urine is mingled with much thick *mucus;* the walls of the bladder become thickened, and contract around the stone, so that with diminished capacity, and inability of distension, the bladder can no longer retain the urine within it, but discharges it every minute. The inflammation may extend to the ureters and kidneys, and it may cause ulceration and other kinds of destruction. In consequence of these symptoms, and of the constant pain which deprives the patient of rest and sleep, the digestive organs are sympathetically affected, the powers sink, and are at last destroyed with symptoms of hectic fever.

2022. These symptoms undergo various modifications according to the constitution of the patient, the nature of the stone, and the place where it is situated. The more sensitive the patient is, the less regular and quiet his mode of living, the greater are his sufferings. The larger the stone is, the more severe are the symptoms. With smooth stones, or with such as are enveloped in a sac, the symptoms are less; but with a stone lying loose, of an angular shape, or of the mulberry kind, they are more violent. If the stone be seated at the orifice of the ureter or in the neck of the bladder, the symptoms are more severe, and in the latter case it may hinder or prevent the discharge of urine; it may, by irritating the openings of the spermatic ducts, produce painful priapism and swelling of the testicles. A stone frequently causes no inconvenience if it be fixed at any one part of the bladder, and the pain only comes on when, by any movement or exertion, it is brought into another place. If a large stone be constantly at the bottom of the bladder, it may cause ulceration of it, and also of the corresponding wall of the *rectum*, and in this way be discharged. The same also may happen in women by ulceration of the wall of the *vagina*. Instances have, however, occurred in which even large stones lying loose in the bladder have been borne for many years without having produced any particular inconvenience.

Each several kind of stone has its own peculiar symptoms (Prout.) With uric acid stones they are generally less severe than with other kinds; the urine is natural, but a little darker in colour; its specific gravity is greater than usual; on cooling, it leaves a crystalline sediment mixed with *mucus*, which increases on any accidental irritation; the urine, at first turbid, becomes clear by standing. With oxalate of lime stones the symptoms are very violent, (I have, however, several times noticed the reverse,) and the urine is clear, and deposits neither uric acid nor phosphates. Stones composed of phosphates produce the most severe symptoms; the urine in this case is quite characteristically curdy, turbid, specifically light, deposits much phosphate and *mucus*, sometimes is alkaline, putrid, stinking, and secreted in large quantity, and the constitution generally suffers considerably.

2023. The above-mentioned symptoms lead to the supposition merely of the presence of a stone in the bladder; a certain knowledge of it can only be obtained by examination with a *sound*, by the distinct feel of a hard resistance, and by the metallic tinkling. Examination (*searching*, as it was formerly, and *sounding*, as it is now generally called) even, can in many cases give only a doubtful result, or none at all; for instance, with a very small stone, such as are for the most part or completely covered by the inner membrane of the bladder, or by a false membrane, or are enclosed in a *diverticulum* of the bladder. As it depends on the size, nature, and position of the stone, whether it be touched by the beak of the sound more readily or with difficulty, so, in making the examination, the bladder must be gently felt all round, and the patient sounded with his bladder full and empty, and in different postures. Examination by introducing the finger into the *rectum* at the same time, may make easy the finding of the stone; and a large stone which lies in the bottom of the bladder may often be distinctly felt by the finger in this way.

Klein (*a*) observes that *silver sounds*, in very sensitive persons, often excite considerable pain and contraction of the bladder, which interferes with the examination of the stone; whilst the *iron sound*, or even an elastic catheter, causes neither pain nor contraction, and easily finds the stone.

[(1) Brodie says:—"In some cases a *calculus* which has not been discovered by means of the sound is at once detected by means of the elastic gum catheter. This is an observation made by Sir Everard Home, the correctness of which I have had frequent opportunity of verifying. The gum catheter should be introduced without the iron stilette, while the patient is standing, with his bladder full of urine. You allow the urine to flow through the catheter, and, as the last portion of it comes away, the *calculus* falls down on the extremity of the instrument, in withdrawing which you feel it quite distinctly." (p. 277.)

It may be well to observe, that if the patient's symptoms continue it will be right to sound him again and again at proper intervals, as the stone may increase in size or alter its position, so that at last, after repeated fruitless attempts during many months, it may be detected. This I have known in more than one or two instances. In rare cases, however, though a stone really exists, it cannot be found by the most careful

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(*a*) Praktische Ansichten der bedeutendsten Chirurgischen Operationen, part iii. p. 35. Stuttgardt, 1819.

sounding, which happened to the celebrated French Surgeon, **La Peyronie**, in whom the stone was only discovered after death.

"There *may* be a stone," **Brodie** observes, "without the usual symptoms, and there *may* be many of the usual symptoms without a stone in the bladder. In children especially, the deposition of lithic (uric) acid sand by the urine will not unfrequently produce not only pain in the *glans*, but bloody urine, and all the other symptoms of stone in the bladder." And he mentions the case of a boy who suffered severely, but no stone could be found after repeated soundings. "I then inquired more particularly," says he, "into the child's health in other respects, and the result was, that I was led to prescribe an occasional dose of calomel and rhubarb, with rhubarb and sal polychrest in the intervals; and under this simple plan of treatment all the symptoms disappeared in the course of a few weeks." (p. 275.)

I have known a similar case as regards the symptoms in a child, of two and a half years, who suffered very severely; a stone was believed to have been felt, and he was cut, but no stone found. No violence was used, nor the bladder irritated by continued use of the instruments; but it being soon discovered that there was no stone, he was put to bed, quickly recovered of the operation, and at the same time lost all symptoms of stone.

A polypus in the bladder may sometimes, from its irritation, produce symptoms of stone, and, being struck by the sound, may lead to the operation. There is a case of this kind in the Museum at St. Thomas's; the patient recovered from the operation, but died some time after, when the nature of the disease was ascertained.—J. F. S.]

2024. By sounding, information can, to a certain degree, be obtained of the size and other conditions of the stone. If the stone be large, it is always felt at the point of the sound, whatever direction be given to it; if small, it frequently slips away, and is only felt at intervals; if it be bossed, the sound is often caught. Hard stones give a clear, and soft ones a dull sound; but in reference to this point the feel is often very deceitful. When a stone does not lie loose in the bladder, but is lodged in a sac, the sound, as it does not touch it *directly*, gives a feel which cannot decidedly distinguish between a stone and a fungous growth or other swelling on the inner surface of the bladder.

Leroy d'Etiolle (*a*) has invented an instrument for measuring urinary stones; it is easy, however, with the greatest care, to be deceived by it, as it is difficult to avoid grasping the stone again and again in the same diameter. The best lithometer is, according to the observations of **Sanson** and **Pigné**, the common sound. When the stone is found, the beak of the instrument is to be carried to the hind end of the stone, and then brought gently forwards, moving it at the same time gently on its axis. At each motion the stone is felt, and if it be noticed how far the sound projects from the *urethra*, at the moment it touches the hind end of the stone, and how much further it projects at the time when the stone can no longer be felt, then the diameter of the stone from behind forwards may be determined. For the purpose of ascertaining the lateral diameter, the sound must be carried from one side to the other, and the extent noted through which its handle passes, by which means the lateral diameter can be measured. In order to hear distinctly the stroke of the sound upon the stone, and to guard against mistake, if the stone be covered with *mucus*, or if a hard part of the wall of the bladder be touched, it has been proposed to apply the ear to the pubic region. **Moreau** and **Berier** have added a stethoscope to the sound. **Pfriem** (*b*) also, and **Leroy d'Etiolle** use a long elastic tube, the upper end of which is furnished with a stethoscope.

[It is often difficult to ascertain the size of a stone, as its position may render it more or less accessible to the sound, and when its diameters are unequal the sound may travel upon it in such way as to give a notion of its size very contrary to that it really has. The readiness with which the stone is struck immediately on the entrance of the sound into the bladder, and the less or greater ease with which it can be displaced are probably among the best means of concluding satisfactorily as to its bulk; and more especially if the time during which the patient has had symptoms of the disease be taken into the account; as if these have existed long, it may be expected the stone is large, whilst the contrary may be presumed if the symptoms have been recent.—J. F. S.]

(*a*) Journal général de Médecine, vol. cix. p. 5. 1829.

(*b*) Das Lithoscop oder Beschreibung eines Instrumentes zur sicheren Diagnose der Harnblasen steine. Würzburg, 1838.

2025. The following are the various modes of *treatment* recommended and employed for the removal of stone in the bladder:—

First, The internal use of stone solvents (*Lithontriptics.*)
Second, The injection of solvents into the bladder.
Third, Solution by means of the galvanic pile.
Fourth, Extraction of the stone through the *urethra.*
Fifth, Breaking up the stone in the bladder (*Lithotrity.*)
Sixth, The operation of cutting for the stone (*Lithotomy.*)

I.—Internal Use of Stone Solvents.

(*Remedia lithontriptica*, Lat.; *Steinauflösenden Mittel*, Germ.)

2026. The *stone-solvents*, which in former times were used in so great number, although without any knowledge of their possible operation, can only by the advance of chemistry, and by a precise knowledge of the constituents of stone in the bladder, attain their proper application and efficiency. The circumstances which have been considered in the treatment of gravel also apply here. (*par.* 2011–2013.) For stones consisting of uric acid, alkalies, for those of phosphates, the use of acids have been recommended, with corresponding dietetic treatment. In regard to acids, it must also be added, that they operate only against the phosphatic *diathesis*, and probably have no effect in dissolving stones, except by injection.

Many empirical remedies consist principally of alkalies, as Stephens's remedy, and others. Some, as so many of the vegetable remedies, operate only by alleviation, through the large quantity of drink combined with their use. Many mineral waters operate both ways.

2027. The efficacy of these remedies has been too highly valued by many practitioners, and by others too much decried. If we cannot expect by the use of these remedies to dissolve large stones, yet, however, their increase may be prevented, the symptoms caused by the stone diminished, and small stones perhaps got rid of. Under circumstances which forbid the removal of a large stone by operation, or after the performance of an operation, to get rid of the *diathesis* producing stone, their employment is always very advantageous.

Upon the effect of pure water see Littre (*a*); of Stephens's remedy, see Morand (*b*), Baume (*c*); of lime water, see White. R. (*d*), Burlet (*e*), Segalas (*f*), Langier (*g*); of magnesia, see Brande (*h*), Hoffmann (*i*); of carbonate of soda, see Mascagni (*j*), Magendie (*k*), Leroy (*l*); of bicarbonate of soda, see Genois (*m*); of the mineral waters of Vichy see Charles Petit (*n*).

Upon the operation of these different remedies, various experiments have been made, and especially the efficacy of the waters of Vichy proved by A. Chevalier (*o*).

Even when, by the continued use of alkalies, the inconveniences of stone in the bladder are arrested; there is, according to Howship (*p*), no proof that it is dissolved; for,

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(*a*) Mém. de l'Acad. des Sciences. 1720. p. 436.

(*b*) Ibid., 1740. p. 177.

(*c*) Elémens de Pharmacie, p. 290.

(*d*) An Essay on the virtues of Lime, in the Cure of the Stone. Edinburgh, 1755.

(*e*) Recueil de l'Acad. des Sc. pour 1700.

(*f*) Essai sur la Gravelle, p. 59.

(*g*) Mém. de l'Acad. de Médecine, vol. i. p. 405.

(*h*) Philosophical Transactions. 1810. p. 186.

(*i*) Observationes et Annotationes, cent. i. cap. v.

(*j*) Memorie della Societa Italiana, vol. xi. No. 34.

(*k*) Above cited.

(*l*) Exposé des divers procédés employés jusqu'à ce jour pour guérir de la Pierre sans avoir recours à l'opération de Taille, p. 59. Paris, 1825.

(*m*) Revue Médicale, 1826. vol. iii. p. 515.

(*n*) Du Traitement médicale des Calculs Urinaires et particulièrement de leur dissolution par les eaux de Vichy. Paris, 1834.—Nouvelles Observations guérisons dans les calculs urinaires au moyen des eaux thermales de Vichy. Paris 1837.

(*o*) Essai sur la dissolution de la Gravelle et des Calculs de la Vessie. Paris, 1837.—See also Willis, above cited.

(*p*) Above cited, p. 102.

by the specific effect of the alkalies on the bladder, its coats are relaxed, and so a sac is formed by the weight of the stone. If, then, the disturbance of the digestion, which has followed the use of alkalies, render the employment of tonic remedies necessary, whereby the muscular activity of the bladder is again excited, the bladder contracts completely around the stone, and encloses it in a blind pouch. Others have imagined, that by the alkalescence of the urine thus produced, a deposit of phosphates upon the stone takes place, by which the irritating effect upon the bladder is lessened.

[The best instance of a stone having undergone partial solution whilst in the bladder is LISTON's case, C. f. 8, in the Museum of the Royal College of Surgeons. It was removed by operation. "The external surface of the *calculus* is very rough and uneven, and in some places is eaten into small holes, which are excavated, or, as it were, undermined at their sides. Its section shows that the concentric layers of uric acid, of which the *calculus* is composed, are not continued entirely round it, but terminate abruptly at those parts which correspond to the excavations on the surface, as if a portion of the *calculus* at these points had been either broken away or dissolved. That these effects, however produced, must have taken place whilst the *calculus* was in the bladder, is shown by the layer of the earthy phosphates covering all its irregularities" (*a*).]

II.—INJECTION OF SOLVENTS INTO THE BLADDER.

2028. Injections into the urinary bladder, which had long been recommended and employed for the solution of stone, were first subjected to definite rules by FOURCROY and VAUQUELIN (*b*). The solution of uric acid and urate of ammonia was to be effected by diluted alkalies; those composed of phosphates, by dilute hydrochloric acid; and those of oxalate of lime, by dilute nitric acid. With the view of acting more powerfully upon the stone, without subjecting the bladder itself to the irritating and solvent materials, it has been endeavoured to enclose the stone in a bag which could withstand the effect of the injection; for which purpose PERCY, CIVIALE, and LEROY (*c*) have made some proposals, and ROBINET (*d*) has recommended a peculiar apparatus, by which the stone may be enclosed in a bag made of intestine, and the injection made by means of a catheter with a double passage.

Phosphatic stones of triple phosphate and lime, are said not to be dissolved by solutions of alkaline bicarbonates, but broken up and converted into powder. Oxalate of lime stones are liable to the same change. (WILLIS.) A. URE recommends the use of hippuric acid, (carbonate of lithia,) from which, however, according to GARROD's and KELLER's experiments, but little advantage can be expected. BERZELIUS, who has expressed himself favourably as to the possibility of the success of injections, and has recommended frequent trials, proposes a lukewarm mixture, of one part of carbonate of potash and nine hundred parts of water, with some mucilage; and in cases where the stone consists of uric acid, a solution of borax.

2029. With the purpose of effecting the solution of the stone by the continued flow of a large quantity of water, or of some chemical solvent, GRUITHUISEN (*e*) has proposed an apparatus, and CLOQUET (*f*) has recommended again the double-passaged catheter previously proposed by HALES.

2030. Opinions as to these modes of treatment differ as much as those upon internal treatment. There are still but few facts which prove the efficacy of this plan of proceeding. The frequent variety in the layers of the stone must not indeed be considered as a very great obstacle to this treatment, as, partly by the nature of the urine,

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(*a*) TAYLOR's Catalogue, part i. p. 92.

(*b*) Mémoires de la Soc. d'Emulat., vol. ii. p. 76.

(*c*) Above cited, p. 88.

(*d*) Répert. gén. d'Anat. et Physiol. pathol. et de Clin. Chir., vol. i. Paris, 1826.

(*e*) Salb. Med.-Chir. Zeit., vol. i. p. 289. 1813.—TEXTOR; in same, vol. ii. p. 94.

(*f*) In LEROY, above cited, pl. ii. f. 7.

by the result of the injections, by the modes of treatment, to be mentioned when crushing the stone is treated of, by the extraction of single fragments of stone, its character at different periods can be ascertained. Stones of oxalate of lime would be dissolved with most difficulty (*a*).

The most recent experiments made on this subject are those of **Pelouze** (*b*), from which it appears—*First*, that the effect of different agents upon urinary stones is less upon the substances of which they consist, than upon the animal matter. The operation proceeds very slowly, even out of the bladder. *Second*, that by drinks and baths a cure is scarcely ever effected. *Third*, that the result of injections, although they act more powerfully, is problematical, and the danger of inflammation is not counterbalanced, as in lithotrity, by a quick destruction of the stone. *Fourth*, that although the combination of lithotrity with injections increases the probability of success, yet it is most advisable to proceed with lithotrity (*c*).

[**Prout** observes:—"When the very weak state of the solvent that can be injected into the bladder is taken into account, the consequent length of time necessary for continuing the experiment, and above all the refractory nature of certain *calculi*, I confess I am very much disposed to doubt if any solvent at present known can, in the great majority of instances, be ever so administered as to produce the desired effect; and this, I believe, is the general opinion on the subject." (p. 284.)]

"It has been observed by chemists," says **Brodie**, "that lithic acid admits of being dissolved by a strong solution of pure or caustic alkali. It has been also observed that *calculi* composed of the phosphates are acted on by the mineral acids, and it may not unreasonably be entertained as a question, how far those changes, which take place out of the body, may be produced while the *calculus* is still in the bladder of a living person. * * * I fear those who have expected by these methods to relieve patients of lithic acid *calculi*, have much overrated the effects of alkaline *lixivia* on them. The fact is, that although alkalies certainly are capable of acting on this kind of *calculus*, their action, except when employed in a very concentrated form, is so inconsiderable, as to amount almost to nothing. Neither the stomach nor the bladder is capable of bearing the quantity of alkali which is necessary to the production of the desired effect; and even if they were, it would be impossible to maintain so constant a supply of the alkali as would be necessary to the destruction of a *calculus* of even moderate dimensions. Mr. **Brande**, moreover, has observed, that the carbonate of potass and soda have no action on lithic acid; that they are incapable of dissolving it; and that if the pure alkali be taken by the mouth, it never reaches the bladder in this state, but only in that of a carbonate; and here then is an insuperable objection to all attempts to dissolve lithic (uric) acid *calculi* by means of alkalies taken into the stomach. When there is a lithic (uric) acid *calculus* in the bladder, and the lithic acid *diathesis* prevails in the system, the first effect of alkalies taken into the stomach is to render the urine neutral; thus preventing the further increase of the *calculus*. So far, then, alkalies are useful. But if they are administered in still larger quantity, so as to render the urine alkaline, the phosphates begin to be deposited. The *calculus* then continues to grow even more rapidly than before; but its composition is altered, and layers of the triple phosphate are deposited on the lithic acid nucleus. Such is the view of the subject taken by Mr. **Brande**." (p. 290-92.)

Brodie shows the fallacy of the statements in reference to the presumed solution of stone, by observing that the fragments occasionally passing, are to be referred to fracture of the stone from mechanical causes, as already mentioned; or that the supposed fragments are in reality new formations, and the result of the medicines employed. As to the cessation of the symptoms, it is no proof the solution of the stone, as by the use of medicine, a fresh coating may be given to it of a less irritating character, and the stone still exist, as in the case of Admiral **Douglas** mentioned by **Astley Cooper** (*d*).

Brodie, however, considers that "the mineral acids undoubtedly exercise a greater chemical action on *calculi* composed of the phosphates than alkalies do on those which are composed of lithic (uric) acid. * * * I found that where the mucous membrane of the bladder was not inflamed at all, or inflamed only in a slight degree, the proportion of nitric acid might be increased to two minims or two minims and a half of the concentrated acid to an ounce of distilled water, without any ill consequence

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(*a*) In the British and Foreign Quarterly Medical Review, vol. xii. p. 398; and also in **Jones**, p. 118, all has been collected in reference to the effects of Injections upon Stones.

(*b*) Comptes-rendus de l'Acad. des Sciences, vol. xiv. p. 429. 1842.

(*c*) **Willis** and **Jones**, above cited.

(*d*) Lectures on Surgery, vol. ii. p. 241.

or even inconvenience arising from it. I next endeavoured to ascertain to what extent a solution of this strength was capable of acting on a *calculus* of the mixed phosphates. The change produced was sufficiently obvious, especially when the solution was made to pass over the *calculus* in a stream for a considerable time. It gradually diminished in size, and at last began to be broken down into minute fragments." For this purpose he at first used a gold catheter with a double channel, through which a constant current was kept up; but afterwards found an elastic gum bottle with a stop-cock, and elastic gum tube attached to it. He first washed out the bladder with distilled water to get rid of the *mucus* lodged in it, and then injected the solution of nitric acid very slowly, using the same liquid over and over again several times. The liquid was afterwards tested with a highly concentrated solution of pure ammonia, and it was found that if the ammonia was added in sufficient, but not too large quantity, the phosphates were precipitated in abundance. Hence he concludes, "*first*, that a *calculus*, composed externally of the phosphates, may be acted on by this injection, so as to become gradually reduced in size, while it is still in the bladder of a living person; *second*, that there is reason to believe that small *calculi*, composed throughout of the mixed phosphates, such as one met with in some cases of diseased prostate gland and bladder, are capable of being entirely dissolved under this mode of treatment, and that it is probable that it may therefore be applied with advantage to some of these cases, in which, from the contracted state of the bladder, or from other circumstances, the extraction of such *calculi* by means of the urethra-forceps, cannot be accomplished." (p. 292–99.)]

III.—OF DISSOLVING STONE BY MEANS OF THE GALVANIC PILE.

2031. **Gruithuisen** (*b*) rests his proposal of dissolving urinary stone by the action of the galvanic pile, upon **Desmortier**'s experiments. **Prevost** and **Dumas** (*c*) have made experiments both out of the body and upon animals. The apparatus consists of an elastic catheter, containing two platina conductors, covered with silk throughout their whole length, except at their ends, which are kept apart by a spring, and attached to an ivory knob, which closes the opening of the catheter. This knob is composed of two hemispheres, each of which is attached to a conductor, so that the flat surfaces where the platina is exposed, comes in contact with the stone. An injection of diluted nitric acid renders the galvanic pile more active than water alone. With this treatment, no experiments have yet been made on men.

[In 1844 an American named **Hull**, in London, attempted to dissolve stone in the bladder by galvanism, but I do not know with what success. The patient had stone, for I sounded and felt it.—J. F. S.]

IV.—OF THE EXTRACTION OF THE STONE THROUGH THE URETHRA.

2032. The shortness and extensibility of the *urethra* in females, and the not unfrequent spontaneous passage of stones of considerable size, have led to the extraction of stones in women, by dilating the *urethra*. Circumstances are less favourable in men, and the instances of voidance of large stones by them are much rarer. According to **Prosper Alpinus** (*a*), the dilatation was specially suited to men, and was performed among the Egyptians by blowing air into the *urethra* through tubes of increasing size, after which the stone was pressed into the neck of the bladder by the finger introduced into the *rectum*, (in women the finger was placed in the *vagina*,) and then the stone was brought out by sucking vigorously at the *penis*. Enlargement of the diameter of the *urethra* to five lines can be effected in men only with much trouble; in most cases such extension is unbearable. Small stones, therefore, can

(*a*) Above cited.

(*b*) Annales de Chimie et de Physique, vol. xxiii. p. 202. 1823.—**Leroy**, Alteration of the Apparatus, in his work above cited, p. 102.

(*c*) De Medicinâ Ægypt., p. 224. Lugd. Batav., 1719.

alone be extracted in this way from men, and the enlargement of the *urethra* is best effected by increasingly thick elastic sounds. When the *urethra* has been sufficiently enlarged, the patient must hold his water, bend himself forwards, and as the sound is withdrawn quickly, the small stone escapes with the stream of urine, or is extracted by a peculiar pair of forceps (1). For enlarging the female *urethra*, Weiss's dilator is used (2).

Forceps of this kind had been formerly proposed by Sanctorius and Severinus, and Hunter's forceps had been employed for the same purpose (*a*). Astley Cooper's forceps (*b*) are especially applicable. According to him such little stones are always lodged in a sac of the bladder behind the enlarged prostate gland, and are frequently not discovered, if in sounding, the point of the instrument be not directed towards the *rectum*, or the front of the *rectum* pushed up by the finger introduced into it (3).

[(1) Brodie, for this purpose, directs the introduction of " a bougie, or a metallic sound, of such a size as the *urethra* will admit without inflammation being induced. Every day, or every other day, according to circumstances, introduce one a little larger, and thus you may dilate the *urethra* gradually, until it is a good deal larger than its natural size. * * * When this process has been carried as far as it can be, let the patient drink plentifully of diluting drinks. It may be worth while even to give some of the compound spirit of juniper or other diuretic, at the same time, and the *calculus* will probably, some time or other, be carried by the current of urine into the dilated *urethra* ;" or, " once daily introduce a large bougie into the *urethra* and bladder, and there let it remain; then let the patient drink plentifully of barley water, or toast and water, or weak tea, so that the bladder may become loaded with urine. When the patient can bear the distension of it no longer, let him place a vessel on a chair, standing, and leaning forward over it; on the bougie being withdrawn, the urine will follow in a full stream, and the *calculus* may probably accompany it." (pp. 281, 82.)

(2) In the female the *urethra* being short will easily dilate of itself, and even permit the passage of a stone weighing an ounce, as in a case mentioned by Astley Cooper; and, " unless a stone be extremely large," he says, " it should be removed by dilatation of the *urethra*, which may, by a speculum or pair of forceps, be opened sufficiently in a few minutes for this purpose. The advantage attending this mode of extracting a stone is, that the passage again contracts, and the urine is afterwards retained. In the first case in which I performed this operation in Guy's Hospital, having used sponge tent, the patient perfectly recovered in a very few days." (pp. 301, 302.) This is not, however, always the case, for sometimes the *urethra* is long before it recovers its tone, and consequently during that period there is a tiresome incontinence of urine.—J. F. S.

Liston (*c*) says:—" The best mode of extracting foreign bodies from the female bladder is to widen the *urethra* gradually by means of the screw dilator, then, by the introduction of a straight blunt-pointed knife, to notch the neck of the bladder slightly towards each *ramus* of the *pubes*, so as to divide the dense fibrous band encircling it; the dilatation is continued, and in a few minutes the finger can be admitted, the stone then can be readily grasped by a pair of forceps; and it is astonishing how large a body may be removed by these means." (p. 525.)

(3) The urethra forceps, commonly called Cooper's, were the invention of Weiss, the instrument-maker, which Brodie considers objectionable, as " it is difficult to explore with it every part of the bladder, and in opening the blades the neck of the bladder is always painfully dilated;" and he prefers another instrument afterwards invented by the same maker, and " composed of two pieces of steel, one sliding longitudinally in a groove of the other. The extremity which enters the bladder is curved, but not in the manner of the common catheter, the curve being more abrupt and the curved part considerably shorter. When the forceps is to be opened the sliding piece is drawn towards the handle, and thus the blades, in being separated, are still kept parallel to each other; they are closed by an opposite movement. * * * The patient should be laid on his back, and it is generally better that his *pelvis* should be supported by a thick cushion, so that it may be higher than his shoulders. The first step of the operation is to introduce a silver catheter, and thus empty its contents. From five to six ounces of tepid water are then to be injected into the bladder, so as to distend it moderately. If any considerable portion of the water should escape, the injection should be

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(*a*) Leroy, above cited.

(*b*) Medico-Chirurg. Trans., vol. xi. p. 359, pl. vi. 1820.

(*c*) Practical Surgery.

repeated, *it being absolutely necessary that the operation should never be attempted on an empty bladder.* The forceps is next introduced, and, of course, with the blades closed. It is first to be used as a sound, so as to ascertain the exact situation of the *calculus.* If this be not readily detected, the patient may be directed to turn on one side, placing himself on his back again afterwards, by which change of position the *calculus* may probably be made to roll into some more convenient place within reach of the forceps. The blades of the forceps are then to be cautiously opened over the *calculus*, and afterwards closed upon it. By this simple management, with a light hand, the *calculus* is seized with facility in many cases, otherwise you may adopt the following method, which rarely fails:—Let the forceps be opened with the convexity of its blades pressed against that part of the bladder which is towards the *rectum*, so as to make it the lowest or most depending situation. Then, by a slight motion given to the handle of the instrument, the *calculus* is made to roll into its grasp, and thus I have often been enabled to remove several small stones at once. * * * When the *calculus* is grasped you may know exactly its diameter by means of a scale fixed to the handle of the forceps." If small, **Brodie** says, forceps and stone may be withdrawn at once; if very large, so that it will not enter the *urethra*, it may be dropped at once, and other means resorted to; but if of intermediate size, and capable of entering the *urethra*, from the easy dilatability of the neck of the bladder, so as to be "drawn into that portion of the canal which lies in the *perinæum*, and there stops, it may then be very distinctly felt through the integuments behind the *scrotum;* and if a small incision be made on it in this situation, it is easily extracted, the forceps, after the removal of the stone, being closed and withdrawn in the usual manner." An elastic catheter must be left in to draw off the water and prevent dribbling through the wound. If the forceps and stone can be brought forward and only "meet an impediment in the anterior part of the canal, that is, at the external orifice or exactly at the anterior part of the *scrotum*, or somewhere in the intermediate space; if the impediment be close to the orifice that part is easily dilated by means of a probe-pointed bistoury; and if it be in another part of the canal, you may remove it by means of an incision made through the skin, *corpus spongiosum*, and membrane of the *urethra. Let me caution you, however, never to make such an incision into the urethra immediately in front of the scrotum.* It is difficult when you do so, even by the constant retention of an elastic gum catheter, to prevent a small quantity of urine finding its way into the loose cellular texture of the *scrotum*, and this may be productive of a succession of troublesome abscesses, or even of dangerous consequences." (p. 283–87.)]

V.—Of Crushing the Stone.

(*Lithotritia, Lithotripsia,* Lat.; *Zertrümmerung des Steines,* Germ.; *Lithotritie, Lithotripsie,* Fr.)

Leroy d'Etiolle, Exposé des diverses procédés pour guérir de la Pierre sans l'Opération de la Taille. Paris, 1825.

Civiale, Destruction des Calculs sans avoir recours à la Taille. Paris, 1823.

——, De la Lithotritie, ou Broiement de la Pierre dans la Vessie. Paris, 1826. 8vo.

Bancal, Manuel pratique de la Lithotritie. Paris, 1829.

Tanchon, Nouvelle Méthode pour détruire la Pierre dans la Vessie sans opération sanglante. Paris, 1830.

Heurteloup, Lettre à l'Acad. des Sciences. Examen critique de l'Ouvrage de M. le Dr. **Civiale**, intitulé, De la Lithotritie, Broiement de la Pierre dans la Vessie, &c. Paris, 1827. 8vo.

——, Principles of Lithotrity, or a Treatise on the Art of extracting the Stone without incision. London, 1831. 8vo.

——, Cases of Lithotrity. London, 1831. 8vo.

Leroy d'Etiolle, De la Lithotripsie. Paris, 1836.

Civiale, Parallèle des divers Moyens de traiter les Calculeux. Paris, 1836.

——, Traité de l'Affection Calculeuse. Paris, 1838.

Schleiss von Löwenfeld, Die Lithotripsie in Bezug auf Geschichte, Theorie und Praxis derselben unter Benutzung der neuesten Erfahrungen der Französischen Aerzte hierüber. München, 1839; with eight plates.

Ivanchich, V., Kritische Beleuchtung der Blasenstein-Zertrümmerung, wie sie heute dasteht. Wien, 1842.

2033. Although hints about the extraction of an urinary stone after previously crushing it in the bladder, are found in Celsus (1) and Albucasis (2), and the successful experiments of two persons upon themselves have been recorded (3), yet Gruithuisen (*a*) made the first actual proposal, in which, by means of a *straight* tube introduced into the bladder, and a wire loop projected out of it, the stone being held fast, was penetrated by a borer or trepan passed through the tube, and the crushing of the small pieces effected by the introduction of forceps through the tube; this was not thought anything of, and partly because the proposed method was considered impracticable. Even Elderton's (*b*) instrument, *curved* like the common catheter, and with two opening arms, by which the stone might be grasped and destroyed by means of a file, was not much regarded.

(1) Celsus (*c*) says:—"Calculus fendendus est. Id hoc modo fit. Uncus injicitur calculo, ut facile eum *concussum* teneat, ne is retro revolvatur; tum ferramentum adhibitur crassitudinis modicæ, prima parte tenui, sed retusa, quodadmodum calculum ex altera parte *ictum* fendit."

(2) Albucasis (*d*):—"Let a slender instrument be taken * * * and gently introduced into the *penis*; roll the stone into the middle of the bladder, and if it be soft, let it be broken and discharged."

According to Haller (*e*), Sanctorius described a three-armed catheter, through which a stilette with a file end was passed, and the stone broken up, and the pieces having been seized by the branches of the catheter, were removed.

(3) The former of these persons introduced, by means of a flexible sound passed into the bladder a straight steel rod with its extremity ground to a point, down to the stone, and struck upon the outer end of the rod, in consequence of which little pieces were separated from the stone and voided with the urine (4). The latter, by means of an elastic sound, carried down a fine file, about thrice in every twenty-four hours, between the stone and the bladder, and used it as a file upon the stone, which he endeavoured to bring near the neck of the bladder (5).

(4) This (*f*) the celebrated case ("if well proved," as Chaussier and Percy observe) of the Monk of Citeaux, and to the notice above given may be added, that having introduced the rod, he struck its end with a hammer with some little sharp sudden strokes, sufficient to detach some little pieces and splinters, which were carried off by the urine, and with which in the course of a year he filled a little box.

(5) This person was General Martin, (*g*) who gives the following account of his proceedings:—"As I generally found the stones by the neck of the bladder, it suggested to me that by making a catheter with small holes on the side, I perhaps could break the sharp points of the stones by passing the catheter between the stones and bladder; this by a small catheter I could introduce between the stones and bladder, and I succeeded in bringing many small pieces away, and after no more. But as I constantly found the stones, my good genius suggested me to make files, and by introducing them on the catheter, and with small motion, I either filed or scraped the whole stones out during about nine months. When I could not get at the stones, I injected warm water in the bladder, which I rejetted or urined out with force, and large stream, and mostly always the stone came to the neck of the bladder and stopped the water, then it was my time to file again, which I did, inclining my body against the wall for to be able to keep the stones as much as I could in position to be able to fill it often. * * * As I saw my progress by many small pieces which I still have, besides the sand, or fine sandy part, it made me persevere in that mode till I brought every piece out, and then, afterwards, I found myself able to walk, ride, &c., as every body else, which I had not done for many years; and I made water very well, though still always a little matter preceded the urine, and also by straining, some few drops came out after the urine." (pp. 251, 252.) How long time was occupied in this process is not mentioned, nor does it appear how long he lived after having, as he stated, thus relieved himself. He died in 1800, and in the note

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(*a*) Salzburg Med.-Chir. Zeitung, vol. i. p. 289, f. 1-9. 1813.

(*b*) Edinb. Med. and Surg. Journ., vol. xv. p. 261, f. 1, 2, 3. 1819.

(*c*) De Medicinâ, book vii. chap. iii. sect. iii.

(*d*) Liber Theoricæ necnon Practicæ. fol. Aug. Vind., 1519. p. 94.

(*e*) Biblioth. Chirurg., vol. i. p. 313.

(*f*) Rapport fait à l'Académie Royale des Sciences, par Chaussier et Percy, sur le nouveau moyen du Dr. Civiale, p. 171. Paris, 1824.

(*g*) Home, Practical Observations on the Treatment of Diseases of the Prostate Gland, vol. ii. 1818.

appended to the letter. Everard Home says:—“There can be no doubt, but the diseased state of the prostate gland was the cause of his death, since the pain of the urine passing over its surface was greater than he could well bear. From his own confession of having a fit of the gravel, after he had brought the stones away, and being obliged to tickle the head of the *penis* before he could make a drop of water, I am strongly disposed to believe, that had the body been inspected, more than one stone would have been found in the bladder.” (p. 259.)]

2034. The path first cleared by Gruithuisen has been retrodden by Civiale, Leroy D'Etiolle and Amussat, and the instruments they have advised, which correspond with those proposed by Gruithuisen, are to a certain extent to be considered merely modifications of his. For this reason the contention between Civiale and Leroy D'Etiolle is of less consequence, as even the straightness of the instrument, the result of Amussat's observations, had been already proposed by Gruithuisen. In other respects, however, the merits of these Surgeons are not diminished, as by their emulation this operation has been perfected and subjected to definitive rules; and as also it was first performed by Civiale on living persons, and not merely brought into practice but its permanence ensured. Besides Civiale, Leroy D'Etiolle and Amussat have most contributed to the improvement of the instruments, Jacobson, Heurteloup and Charriere's inventions especially, to the simplification and greater certainty of the practice, so that of late years this operation has been brought to a great degree of simplicity and perfection.

2035. The numerous instruments recommended for the practice of lithotrity have this in common, that having been introduced through the *urethra* into the bladder, they *grasp* and *fix* the stone, and by a force exerted upon it, break the stone into *so small pieces*, that they can pass through the *urethra*. All these instruments may be most conveniently arranged under three classes:—First, *the stone being grasped by its periphery, is gradually destroyed towards its centre;* second, *it is perforated, to render it breakable, so that it may then be crushed*; third, *it is then crushed, by pressure from its periphery, towards the centre.*

To the *first* class of these instruments, which effect the gradual destruction of the surface of the stone, belong the instruments of Elderton, (1819,) of Meyrieu, made public by Tanchou, (1830,) of Recamier, (1830,) which fix the stone with forceps, and act upon it with the file; Rigal's (1830) instrument, which fixes the stone with a perforator, for the purpose of moving it upon the file-like surfaces of the arms of the forceps (*foret à chemise.*)

To the *second* class belong the instruments of Gruithuisen, (1812,) of Civiale and Leroy D'Etiolle, (1823,) with the modifications of Griffiths, Luckens, Scheinlein; of Heurteloup, (1828,) and of Rigal, (1830,) for the purpose of breaking the stone by an eccentric power; of Pravaz, (1830,) curved like a common catheter, and similar to that of Benvenuti (1830.) The form of perforator as given by Civiale, Leroy, Amussat, Greiling, Charrière, and others, varies very much.

In the *third* class are Amussat's instrument, (1832,) Heurteloup's *brise-coque*, (1828,) Jacobson's instrument, (1830,) with its modification by Dupuytren, who increased the number of limbs for the purpose of getting rid of the angles, which the grasp forms; Leroy and Greiling's instruments; the *percuteur* of Heurteloup, (1832,) with the alterations of Segalas, Bancal, Amussat, Weiss, Civiale, Leroy, Benique, Charrière, and others; Charrière's *percuteur à pignon*. Schleiss has attached a perforator to the *percuteur* so as to act in two ways upon the stone. The description of these instruments, which would be insufficient, is omitted, and the reader is referred for their complete description and engravings of them to the works of Leroy d'Etiolle, and others, and especially to those of Schleiss, von Löwenfeld, and others (*a*).

(*a*) Above cited.

2036. The history of lithotrity affords a sufficient opportunity for deciding on the fitness of these various instruments. Those which effect a gradual rubbing away of the surface of the stone have never enjoyed any particular favour. The perforating instruments, although they led to the direct introduction of lithotrity, have been set aside by JACOBSON's lithoclast; and both have been, to a certain degree, supplanted by HEURTELOUP's *percuteur*. From a close examination of the three-limbed perforating forceps of CIVIALE, and LEROY, of JACOBSON's instrument, of HEURTELOUP's *percuteur*, with screw and hammer, or *à pignon*, there seem to be good grounds for their employment and effect.

2037. The *three-limbed perforating forceps* are indeed generally introduced with ease; but there are circumstances in reference to the state of the prostate, which may render their introduction difficult, and even impossible. In general they readily grasp a large stone; but the entrance of a large stone between their branches may be difficult, and it may also be exceedingly troublesome to grasp a small stone; their expanded branches may also injure a corresponding number of points on the walls of the bladder. When the stone is grasped it cannot easily escape, its rubbing into fine powder is very favourable for its discharge; but at its final breaking up, there still remain fragments, the grasping and crushing of which is very difficult. Hence arises the tediousness of this method; the stone must be grasped, bored, and let go, must be again grasped and bored, till it can at last be broken up. These manœuvres are difficult, tedious, and painful, to both patient and operator. One limb of the forceps may get into one of the bored holes, from which it is freed with difficulty; the perforator itself, if it operate on an irregularly-shaped stone, and which is perforated at one part, may act upon one arm of the forceps, and injure, or even break it.

2038. JACOBSON's instrument is easily introduced; searching for and grasping the stone with it is less dangerous, as when it is opened, the stone almost of itself gets into it; on account of its curve, however, it is difficult to sound certain parts of the bladder—for instance, near its neck. Flat stones are always seized with more difficulty by it than by the three-limbed forceps, and not always easily fixed. The stone is sometimes broken slowly, without pain, and without the pieces striking injuriously against the walls of the bladder. No stone can resist its action (DUPUYTREN, PIGNÉ); and if the instrument should break, its pieces remain connected with the body of the instrument, and by giving it the proper direction, may be withdrawn with it, without danger or difficulty. The dimensions of the instrument, however, may be so large that it cannot grasp a large stone; it is, therefore, suitable only for small stones. It is, above all, necessary that the stone should be caught in the middle, as otherwise it is difficult to fix, and easily escapes. Lastly, the remainder of the stone may continue attached to the branches of the instrument, and render its withdrawal difficult, or even impossible: this awkward circumstance is, however, prevented by LEROY's modification.

2039. HEURTELOUP's *percuteur* is most easily of all introduced into, and managed when in, the bladder. Stones of every shape and size can be firmly grasped by it, and their escape is less to be feared than from any other instrument. The position of the stone, when seized, can be more easily changed, its size measured, and every part of the bladder more readily examined, by the angular curve of the instrument. Its operation is powerful and quick; large stones can be crushed with it more quickly and with less effort, and are converted into a coarse soft powder; but the fragments of hard stones are very angular and sharp-edged, and produce, by irritating the bladder, pain, difficulty in their passage through the *urethra*, and frequently their lodgement there. The strength of the instrument, notwithstanding its small size, in comparison with others, is, when properly used, so great that there is no fear of its breaking. To this may be added, that it is by far the least costly instrument. The *percuteur*, therefore, possesses all the advantages of the other instruments, without any of their disadvantages, and it may be with certainty presumed that it will supersede them all.

2040. Before proceeding to the operation, the most perfect information must be obtained, by examination of the position, form, size, and consistence of the stone and of the state of the urinary organs. For this purpose a common catheter may be made use of as already directed (*a*). If there be no circumstances contraindicating lithotrity, if no further preparation of the patient be requisite, or it have been already made, the *rectum* must be emptied with a clyster some hours previous to the operation.

Previous to the introduction of the straight perforator, Civiale and others have for the space of a fortnight, in addition to very strict diet and luke-warm bathing, enlarged the canal of the *urethra*, by the daily use of elastic bougies, to such extent as to render the introduction of the instrument easy. The patient is thus at the same time accustomed to the irritation of a foreign body, on which account Civiale also uses bougies, even when the passage of the *urethra* is sufficiently wide.

2041. The patient should lie upon a common bed, or upon a table covered with a matrass, both of which should be sufficiently high, that the operator have not to stop. It should also be narrow, and the matrass firm. The buttocks are to be raised on pillows, the back flat, the shoulders and head a little raised. The patient should either lie lengthways and the operator standing on his right side, or obliquely, with his rump on the edge of the bed, in which position his feet are either to rest on a stool, or to be supported by assistants, and the operator stands between his thighs.

The beds specially for this purpose, as recommended by Heurteloup, Bancal, and Tanchou, are thus rendered superfluous, although they are advantageous, by placing the patient easily and quickly in the fitting posture, and giving the operator more facility and security. Rigal's chest-like contrivance, which contains all the lithotriptic instruments, may also be placed on a table to give the patient a proper position. The apparatus used for firmly fixing the instrument to the bed, when the stone is crushed with the hammer, is not necessary; for, even if the hammer be used, the instrument can be fixed by the hand alone, or by a movable holder, as the crushing of the stone must only be attempted by light short strokes, and an immovable fixing of the instrument may, if the patient move, cause mischief.

2042. After voidance of the urine, a quantity of lukewarm water, corresponding to the capacity of the bladder, is to be injected through a silver catheter, till a visible or sensible enlargement of the region of the bladder is produced, or the patient has an urging to make water. The aperture of the catheter is then stopped with the thumb, and the existence and position of the stone once more examined; after which the catheter having been withdrawn, the lithotriptor is introduced.

If the orifice of the *urethra* be very narrow, it must be enlarged downwards with

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(*a*) Catheters specially for examination, and of similar construction to that of Heurteloup's *percuteur*, are given by Schleiss.

Civiale's bistoury, or with a narrow button-ended bistoury, to the extent of a line or two.

2043. In using the three-limbed perforating forceps of Civiale and Leroy, the instrument, closed and properly oiled, must be held with the fingers of the right hand, and the *penis* with those of the left, so directed that it occupies a middle position betweeen erection and relaxation; consequently almost at a right angle with the body, but forming towards the belly a somewhat obtuse angle. The same direction being given to the instrument, it is introduced into the *urethra*, and with gentle twirling and pushing alternately, carried on till it come to the under part of the pubic arch, without changing its direction, or that of the *penis*. The instrument and the *penis* are now gradually sunk down, at first parallel to the horizon, and then brought so far below it as can be done without any great difficulty, and then its point gently pushed forwards. If this cannot be done, the instrument must be again raised and sunk till the point get under the pubic arch; the instrument is then carried in the same direction through the prostatic part into the bladder, which is indicated by a peculiar feel, by the free movement of the instrument, by the escape of a few drops of urine, and by urgency to make water. If there be still some resistance before the instrument enter the bladder and it cannot be sunk lower, the part of the instrument projecting from the *urethra* must be gently raised, and the neck of the bladder thereby be somewhat depressed.

2044. The stone is in general found without much difficulty, if not very small, and if the patient be quiet; and when found, the instrument must be drawn a little back, without causing the least shock, and opened more or less, according to the size of the stone; and then, first the outer canula, and afterwards the borer, are to be attached. At the same moment that the instrument is pushed a little forwards, the opened limbs of the forceps surround and grasp the stone, then the three-limbed canula is attached to it and fastened by the screw. By means of the scale fixed on the three-limbed tube, and by pushing the borer towards the stone, it is ascertained that the latter is actually fixed, and its size is made out. The frequent difficulty of grasping the stone may be rendered more easy by changing the patient's position, or by pressure on the region of the bladder.

2045. If the stone be very small, it may be at once pulled out. If it be very brittle, it often breaks by the closing of the forceps. But when this does not happen, the instrument should be laid into the hand-vice, and the borer moved against the stone by means of the bow, on which a dull or clear murmur is perceived. If the stone be in this way broken to pieces, all the pieces rarely fall out of its limbs, and the measure on the again retracted canula shows whether the piece grasped will pass through the *urethra*, or whether it must be still more broken. In the latter case, after the canula has been fixed, with the screw, the borer must be again employed. The instrument is then to be slowly withdrawn by moving it gently from above downwards, and from right to left, observing the same direction as on its introduction. If in doing this there be still any obstacle, which is usually the case at the *fossa navicularis*, the borer must be again applied to the stone, to render it still smaller. The pieces in the bladder generally escape with the injected water, or with the urine through the enlarged *urethra*. If, however, the stone be firm, and the borer merely pierce without breaking it, the borer must, with certain intervals, operate only so long on the stone, till there is but a line from the tip of the forceps. Attempts must then be made either to give the stone another position, and operate with the borer on its other side, or if the patient be fatigued, the operation must be stopped.

2046. Jacobson's *instrument* is introduced just as a common catheter. Having reached the bladder, gentle movements are to be made with its beak to find the stone; the instrument can also be twisted to the half of its long axis, so that its point may be directed against the back of the bladder, the handle of the instrument raised, pushed gently forwards and backwards, to one or other side, so as to sound every part of the bladder. When the stone is found, the curved part of the instrument is to be laid on its side upon it, the movable branch pushed forwards, so that the loop is formed within the bladder, and then by lateral movements of the instrument, or by correspondingly raising and sinking one part of the *pelvis*, attempts are made to bring the stone into the loop. When the stone is believed to be caught in its middle, the movable branch is drawn somewhat back, so as to diminish the size of the loop. In order to break the stone now grasped, the screw is to be turned from left to right, as far as its length allows. If the stone be broken, the loop is to be again opened, and it is again attempted in the same way as at first, to grasp the single fragments, and to crush them, which must be repeated as often as any fragments are to be found for crushing, and the patient does not express any considerable pain. When the instrument is withdrawn, its movable branch must be pushed sufficiently forward till it be completely closed, and if this be prevented by any fragment, the loop is to be repeatedly opened, and the instrument made to move in different directions, for the purpose of getting rid of the fragments from the loop; and then when the instrument is completely closed, it may be withdrawn like a catheter. The instrument is used in the same way for repeatedly crushing the stone fragments.

2047. Heurteloup's *percuteur* is introduced into the bladder like a catheter, and the stone searched for with it. The instrument is then opened by withdrawing its male branch, as much as the size of the stone requires, which then falls into the concavity of the female branch, almost of itself, or by some special movement, and is then caught by pushing down the male branch. The beak of the instrument is now brought into the middle of the bladder, the female branch held with the left hand, and a slowly increasing constant pressure made upon the end of the male branch with the right hand. The gradual driving forwards of the male branch, the sensation of crushing and the noise often accompanying the breaking up of the stone, as well as the sudden driving forwards of the male branch and the complete closure of the instrument, show the escape of the stone. If the pressure of the hand be insufficient for crushing the stone, more force by means of machinery, is employed, by which the results just mentioned are produced. If pressure with the hand be insufficient to break up the stone, the female branch of the instrument must be fixed with the hand-vice already mentioned, or to the proper apparatus on the bed, and the extremity of the male branch struck with light, equal, quick, and short blows of a hammer, so that the stone is gradually split and at last completely smashed in pieces. When the male branch has been driven some way down, the hammering may be given up, and the further crushing effected by the hand or by the machinery. In this way is the operation to be continued till the male instrument has entered completely, and the instrument is perfectly closed, by which the actual crushing, or the escape of the stone is shown. In the latter, as in the former case, the stone, or its pieces, must be again caught, and they must be crushed as already described, and the process repeated till the stone is completely broken to pieces, unless great urging to pass the urine, diseased contraction of the bladder, and discharge of the urine, violent pain, the patient's distress and the like, prevent the completion of the operation. After the fragments still clinging to the instrument have been got rid of, by pushing forwards, and pulling back its male branch, and by other gentle motions, and the instrument *completely closed*, it must be withdrawn by a gentle rotatory motion. If there be yet any obstruction from a little piece of stone between the branches of the instrument, it must be again pushed into the bladder, and attempts, as already mentioned, made to get rid of it, so that the instrument may be withdrawn completely closed.

2048. The duration of a lithotriptic sitting, depends on the sensibility of the patient and the symptoms it produces. In general, it occupies five or six minutes, but persons who are not very sensitive, can, without inconvenience, bear it much longer. The symptom usually arising after the introduction of the instrument, is, violent urging to make water, which, however, often ceases, when the instrument is managed gently, or a few drops of urine have escaped. If a large quantity of urine be voided, and in consequence of other circumstances, the operation be still continued, it must be proceeded with only with the greatest caution and tenderness, on account of the great danger of injuring the walls of the bladder.

2049. After the operation, the treatment must be directed to the prevention and removal of the irritative and inflammatory symptoms, and the passage of the fragments of stone through the *urethra*. The patient must be kept quiet in bed, or the generative organs supported in a suspendor, and he should take only thin broth and mild mucilaginous drink, till no trace of irritation remain. But when this has completely ceased, he may gradually return to more and solid food, sit up, and go about for any length of time, but always having the generative organs supported. If febrile symptoms, inflammatory irritation and swelling of the mucous membrane of the bladder and *urethra*, of the prostate and generative organs, and of the inguinal glands occur, antiphlogistic treatment, suiting the degree and character of these symptoms, and the constitution of the patient, by general or local blood-letting, lukewarm baths, washes and internal treatment must be resorted to. If with these symptoms, general coldness of the body, and weak, often very small pulse show a prostration of the powers, then dry rubbing, aromatic applications, the internal use of aromatic infusions, and even of volatile irritants, with due caution, must be employed. Inflammatory affections of other organs, which, although depending on the constitution of the patient, may be excited by the operation, require the closest attention and corresponding treatment.

2050. The escape of sand and small portions of stone produced by the crushing, generally follows the first voidance of the urine, and is repeated each time it is afterwards passed; accompanied with more or less burning sensation in the *urethra*, but without further irritation. Small fragments, even up to four lines, if they be round, do not in general cause any particular symptoms; but if larger, hard and angular, they irritate and wound the mucous membrane of the *urethra*, excite inflammation, get fixed most commonly in the *fossa navicularis*, and producing difficulty in passing or entire retention of urine, excite the most violent and painful symptoms. This fixing of the fragments of stone in the *urethra* is very frequent, according to Leroy in four cases to one, and hence has arisen the great number of instruments proposed for their removal. Often, however, even small pieces cannot be forced out, because either the bladder is paralysed or its neck is spasmodically contracted.

2051. To prevent this accident, various plans have been attempted to get rid of the fragments of stone from the bladder. Heurteloup with his *lithocenose*, a straight or curved steel canula, with two side openings and a hemispherical terminal piece introduced into the bladder, injects water, and allows it to flow out again. The small pieces escape with the water, the larger get entangled in the openings, and must then be broken up, either by the introduction of a solid tube, or with a toothed knob, which can be rotated (Leroy.) This operation may be often repeated without removing the tube till its blind end is loaded with the fragments of the stone. Heurteloup also uses spoon-shaped forceps in form of his *percuteur*, and Leroy the small instrument of Jacobson, introduced through a canula. Schleiss (*a*) has for this purpose constructed an evacuating catheter, after the fashion of Heurteloup's *percuteur*, by which he can at the same time inject; and some have also employed Cooper's curved forceps. All the instruments, however, with which fragments are caught hold of and drawn through the *urethra* are attended with danger of wounding, and injuriously irritating the *urethra*, in consequence of the projection of the angles of the fragments.

2052. Fragments of stone fixed in the *urethra* must be either thrust back into the bladder, or drawn out through the *urethra*, or removed by a cut into the *urethra*. The suitability of one or other of these modes of proceeding must depend on the seat of the lodgment of the fragment: if the piece of stone be fixed in the neck of the bladder, or if it have not passed the prostatic part, it is most easy and proper to push it back into the bladder, which may be done with a thick elastic or metal catheter, or by forcible injection into the bladder, so that, when the piece has been there pushed, it may be further crushed. When the fragment has penetrated into the membranous part, it often cannot be pushed back into the bladder, as the enlargement of the prostate in the *urethra* which frequently accompanies stone, opposes its return; it is then more advisable and necessary to pull it out; and the same practice must be adopted in reference to fragments in the fore part of the *urethra*.

2053. A variety of instruments have been employed for withdrawing fragments of stones fixed in the *urethra*; some of these were known in old times, others have been proposed since the introduction of lithotrity, in consequence of the more frequent occurrence of this accident. The old instruments are, Lamotte's forceps, in shape of a snipe's bill; Hunter's or Hales's forceps; Fabricius Hildanus's forceps; Paré's borer; that of Fischer for crushing the stone; and Marini's metal loop. The later instruments are, Hunter's forceps, modified with a movable branch; Cloquet's metallic loop, which is passed through a canula, and drawn together by means of a screw, so as to crush the stone when caught;

(*a*) Above cited, pl. viii. f. 15, 17.

Colombat's figure-of-eight loop; **Jacobson**'s miniature instrument; **Cooper**'s curved forceps; **Amussat** and **Sagalas**'s small *percuteur;* **Civiale**'s hook; **Leroy**'s three-limbed forceps, with or without a borer; **Amussat**'s four-limbed forceps; **Leroy**'s jointed *curette*, with **Dubowisky**'s modification, which has a borer added; **Leroy**'s urethral forceps, with an articulated *curette*, and a *percuteur* with a *curette;* and **Amussat**'s and **Sanson**'s catheter furnished with a very large side opening.

2054. From the number of these instruments may readily be comprehended the difficulty accompanying the withdrawal of the fragments of stone from the *urethra.* Their use always requires the greatest circumspection and care. The straight or curved cannular forceps of **Hunter**, **Leroy**, and others, are in general the most fitting, as are also **Cooper**'s forceps, when the fragments are deeper seated in the membranous part of the *urethra.* **Leroy**'s jointed *curette*, indeed commonly grasps the stone, but only moves, without drawing it out, if it be not also fixed or crushed by the borer. According to **Pigné**, **Sanson** has in several instances where he had in vain used the most suitable instruments, effected the withdrawal of stone by means of an elastic catheter, with one or two large side openings, with the greatest ease and without pain. The position of the fragment of the stone is first determined with a metallic catheter, which is then withdrawn, and an elastic catheter with its metal stem passed down to the fragment, shows its place a second time, by rubbing against it; the metal stem must then be drawn back about two inches, and by twisting the catheter, its opening must be endeavoured to be applied to the stone, which almost always at once gets into it, and is withdrawn with the catheter. If the fragment be quite close to the orifice of the *urethra*, it may, after slightly enlarging the orifice with a little cut downwards, (*par.* 2042,) be pulled out with a pair of common forceps.

2055. If a fragment of stone stick so fast in the *urethra*, that it can neither be thrust back into the bladder, nor pulled out, and if it be situated at an accessible part of the *urethra*, the coverings must be cut through, and the fragment removed through the wound. An elastic catheter must then be introduced into the bladder, and the wound perfectly united.

2056. When after the escape of all the fragments of stone, no further symptoms appear, a close and careful examination of the bladder must be made, according to the rules already laid down, to be perfectly satisfied that there is no remnant of the stone, which may cause its reproduction. Prudence also requires that the examination should be repeated from time to time, before it can be ascertained that the patient is quite freed from the stone.

2057. Crushing the stone is effected in women in the same way, and according to the same rules as in men. The shortness, greater width, and extensibility of the female *urethra* render the introduction and management of the instrument, as well as the withdrawal of large fragments of stone, easier. It must, however, be remembered that on account of this very condition of the *urethra*, it is more difficult to retain the proper quantity of the injected fluid, and that the stone mostly lies on the sides of the bladder, on which account it may be more easily seized with curved than with straight forceps. The finger, however, introduced into the *vagina* can alter the position of the stone, and bring it to the instrument.

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OF CUTTING FOR THE STONE, OR LITHOTOMY.

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2058. The *operation of cutting for the stone* consists in the artificial opening of the bladder or of its neck, at some one part, and to such extent as will allow the removal of the stone. This operation should always be undertaken as soon as possible, because otherwise the stone enlarges, and renders the operation proportionally more difficult and dangerous. It is, however, contraindicated in severe continued pain in the kidneys, which depends either on stone, suppuration, or other destruction of those organs; in ulceration of the bladder, which may be distinguished from its simple blennorrhagic affections; in considerable thickening or carcinomatous degeneration of its walls; also when the powers are very low sunk, and there has been previous wasting fever; in great enlargement of the stone; and, finally, in its being completely encysted. The operation must be deferred if there be any accidental or passing disease, if great inflammation of the bladder and its neck, if much sympathetic irritation of the digestive organs, continued uneasiness, vomiting, and the like, as also if there be stricture of the *urethra*, until the passage be restored.

The circumstances which contraindicate cutting for the stone require close and careful consideration, as experience frequently shows that, even under the most unfavourable circumstances the operation is successful, and that with the removal of the stone, the symptoms depending on its presence, as for example, the chronic inflammatory affection of the bladder, cease. If it be well ascertained that the stone is encysted, it being perfectly so, must decidedly contraindicate the operation, as in most cases it is impossible to set such stone free, or the case may terminate fatally. An enormously large stone can only be considered as contraindicating one special mode of operation. Cases may occur, though very seldom, in which, though the presence of a stone in the bladder is proved by sounding, few or no symptoms occur; its enlargement is very gradual, and the operation does not seem to be necessary. It is always, however, to be feared, that in deferring the operation till the appearance of symptoms which require it, such changes may accrue as will render its result doubtful. This especially applies to young persons; as, on the contrary, in old persons, the operation must be considered to be contraindicated (1).

[(1) "The age of the patient," says ASTLEY COOPER, "does not much influence the result of the operation, with the exception I shall mention. Old age is not to be a bar to it if, so far as the stone will permit, the patient be active and have no other complaints. Mr. CLINE, senior, operated successfully upon a patient at eighty-two; Mr. ATTENBURROW, of Nottingham (2), at a still more advanced age. I operated on a gentleman aged seventy-six, and he died about ten years after. About sixty years of age is the period at which stone is most frequent in the adult, and then the operation is very successful. In the middle period of life, fever is more violent from the operation, and the patient is often too much loaded with fat to be submitted to it. Fat persons do not generally bear operations well; they have little vital power; they should be reduced by diet and medicine; and they must be accustomed to irritation of the bladder, by the frequent introduction of the sound; but still they have more fever and disposition to peritonæal inflammation than at a later period of life. The age at which there is least danger is from three to twenty, for death is then a very rare occurrence. Under the age of two years, children often become convulsed, and die from the operation, on account of their excessive irritability." (pp. 244, 45.)

(2) His son informs me that this patient was eighty-five years old; and that his father had also operated on a man of eighty-seven, who lived to the age of ninety-five.

The earliest age at which I have known the operation for stone performed with success was twelve months, in two instances successfully by KEATE, at St George's Hospital. JOHN HUNTER operated on a child of eighteen months, but the result is not stated. I have recently cut a child of twenty months, but he died on the fourteenth day of peritoneal inflammation, accompanied with small abscesses in the immediate neighbourhood of the wound. CIVIALE (*a*) has, however, collated many instances of infants affected with stone, one of which was cut at ten weeks, but with what result is not stated.

Although fat persons are not very favourable subjects for stone-operations, yet with management they may do well. My friend GREEN cut a man about fifty, who a short time before the operation weighed eighteen stone, but had been reduced, and the girth of whose waistcoat was nearly two yards. He did well of the operation, but stone formed again; he was lithotritized, and died with inflammation of the mucous membrane of the bladder.—J. F. S.]

2059. If the stone-patient's health be otherwise good and his mode of living regular, it will be sufficient preparation for the operation to diminish, a few days previously, the ordinary quantity of his diet, to bathe him several times in lukewarm water, and for the two immediately previous days to restrict his diet further, and to give clysters. In full-blooded persons, one or two bleedings should be resorted to; in hæmor-

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(*a*) Traité, above cited, p. 506.

rhoidal affections, and specially with loading of the liver, leeches must be applied to the *anus*. In stout persons, with weak constitution, the condition of the juices and the state of the bowels must be attended to, as this kind of constitution may be most prejudicial to the result of the operation. Under these circumstances bathing must be used with the greatest caution, and tonics are often called for. The use of purgatives, commonly employed in the preparatory treatment to cutting the stone, requires care; if necessary, at least a few days must intervene between their use and the operation. If the patient have worms, they must either be first got rid of, and then the operation be performed; or he may be left to his ordinary quantity of diet, attention being paid to its quality, and on the day before the operation have broth three or four times, according to his appetite, and on the morning itself, bread soaked in beef tea or rice porridge. Old persons are to be treated in the same way. In country people, who are accustomed to coarse food, a quick change of food, and to a lighter kind, may be unfavourable to the result of the operation. In very sensitive subjects, small doses of *opium*, *extract. hyoscyami*, or *aq. lauro-cer.*, may be administered.

A.—Of Cutting for the Stone in Men.

2060. The history of cutting for the stone presents six different modes in which it is performed on the male, to wit:—

First, Cutting with the little apparatus.
Second, ,, ,, great ,,
Third, ,, ,, high operation.
Fourth, ,, by the lateral ,,
Fifth, ,, into the body of the bladder from the *perinæum*.
Sixth, ,, through the *rectum*.

2061. *Cutting for the Stone with the Little Apparatus*, (*Apparatus parvus*, *Hypocystomia*, Lat.; *der Steinschnitt mit der kleinen Geräthschaft*, Germ.; *la Taille par le petit Appareil*, Fr.,) called also Celsus's method, because he first described it, consists in making a cut upon the stone through the *perinæum* and neck of the bladder, and drawing it out with a stone-spoon. This plan remained the only one, and unchanged up to the sixteenth century, when it yielded to the great apparatus, and was almost entirely confined to childhood. Heister and Morand alone have, in more modern times, taken it under their protection.

2062. A strong man sitting on a chair takes the patient on his lap, and holds the thighs bent at the knee properly apart. If he be not in this way sufficiently fixed, the feet must be held by other assistants on each side. The operator introduces two fingers of his left hand into the *anus*, and endeavours, whilst with his right hand above the pubic *symphysis* he presses the belly downwards, to push the stone into the neck of the bladder; then, upon the projection formed by the stone in the *perinæum*, on the left side of the *raphe*, he makes a semilunar cut, the horns of which are directed towards the left hip-socket, through the *perinæum* into the bladder, divides its neck by a second *transverse cut*, and pulls out the stone with his finger or with a stone-spoon.

Such is the usual interpretation of the text of Celsus:—"Ut super vesicæ cervicem fit, juxta anum incidi cutis *plaga lunata* usque ad cervicem vesicæ debet, cornibus *ad coxas* spectantibus paululum: deinde ea parte, qua strictior ima plaga est, etiamnum sub cute, altera transversa plaga facienda est, qua *cervix* aperiatur" (*a*). As a deviation from

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(*a*) De Medicinâ, lib. vii. cap. xxvi.

this text, must be considered the direction, to press the stone *upon*, and not *into*, the neck of the bladder, by which process the cut seems to be made into the *body* rather than into the *neck of the bladder*, which HEISTER distinctly directs; according to whom, the parts which must be cut through are, the skin, the fat, and between the left *m. erector penis* and the bulb, *the hinder and under part of the bladder up to its neck.* According to BROMFIELD (*a*), the semicircular cut should be carried in such way above the *anus*, that it may pass through the *raphe* and its horns lie opposite to the ischial tuberosities. This statement, which is objected to by CLOSIUS (*b*), was assumed by CHAUSSIER (*c*) and by BECLARD (*d*), to be the true interpretation of the text of CELSUS, and both these Surgeons have proposed a peculiar practice by the addition of a staff, which DUPUYTREN adopted successfully in a living person in the year 1824. This proceeding, in which the neck of the bladder is cut into on both sides, in a corresponding direction to the external cut, will be more fully entered into in considering the *lateral operation* (*e*).

The objections to this interpretation may be found in JOURDAN (*f*), TURCK (*g*) and in BEGIN (*h*). SCHÖNMANN (*i*) defines the external cut, as being semilunar with its convexity towards the hip-socket, its upper horn towards the left side of the *raphe*, and the lower towards the left ischial tuberosity.

2063. This mode of treatment, which has only historical value, is deservedly objected to, as it is very difficult, and sometimes impossible to press the stone into the neck of the bladder, which is bruised by so doing; as there is no certainty of what parts are cut through; and as the operation is performed without a staff, the *urethra* may be cut through transversely, and the ureters, seminal vesicles, and the *vas deferens* of the left side may be injured (*j*). It can only be called for in the rare case of a stone developed in the neck of the bladder, forming a distinct projection in the *perinæum*, and when no staff can be introduced.

Upon this operation the following works may be consulted :—

CELSUS, De re medicâ, lib. vii. cap. xxvi.

ILSEMANN, J. G., (Præs. L. HEISTER,) Dissert. de Lithotomiâ Celsianæ præstantiâ et usu. Helmst., 1745.

CLOSSIUS, Analecta quædam ad historiam Lithotomiæ Celsianæ. Tubing., 1792.

TURCK, De l'Incision pratiquée par CELSE, dans l'Opération de la Taille chez les Hommes. Strasb., 1818.

2064. *Cutting for the Stone with the Great Apparatus*, (*Apparatus magnus*, Lat.; *der grossen Geräthschaft*, Germ.; *le grand Appareil*, Fr.,) so named on account of the great number of instruments required for the operation, was invented by JOHANNES DE ROMANIS in the beginning of the sixteenth century, and subsequently made public by MARIANUS SANCTUS DE BARLETTA, on which account it was long called the SECTIO MARIANA. This method consists in first passing a staff into the bladder, in opening the *urethra* in its spongy part, by a cut through the *perinæum*, and in enlarging the neck of the bladder, by particular instruments, to such extent that the stone can be pulled out.

2065. The patient having leaned backwards on an oblique surface, was placed upon a high stool, or on the edge of a table; his hands bound to his feet, which were drawn up and separated from each other, and at the same time several turns of the bandage passed round his neck and

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(*a*) Chirurgical Cases and Observations, vol. ii. p. 218.

(*b*) Analecta quædam ad historiam Lithotomiæ Celsianæ. Tubing., 1782.

(*c*) MORLAND, Dissert. Propositions sur divers objets de Médecine. Paris, 1805.

(*d*) Propositions sur quelques points de Médecine. Paris, 1813.

(*e*) ILSEMANN, J. G., (Præs. L. HEISTER,) Dissert. de Lithotomiæ Celsianæ præstantia et usu. Helmst., 1745.—TURCK, De l'Incision pratiquée par CELSE dans l'Opération de la Taille chez les Hommes. Strasb., 1818.

(*f*) Article *Lithotomie*, in Dict. des Sc. Médicales, vol. xxviii. p. 384.

(*g*) Journal Complément. du Dict. des Sc. Med., vol. iii. p. 184.

(*h*) Supplement to DESCHAMPS, Traité p. 420.

(*i*) Commentatio de Lithotomiâ Celsianâ. Jenæ, 1841.

(*j*) JOHN BELL, Principles of Surgery, p. 59, pl. v. London, 1815.—FRORIEP's Chirurg. Kupfertaf., pl. lxxi.

shoulders, and himself held by assistants. A staff was then introduced into the bladder, with which it was attempted to ascertain the presence of the stone, and at the same time, also, if possible, its size. The handle of the staff was given to an assistant, who inclined it a little towards the belly, and at the same time also raised the *scrotum*. A cut was then made on the left or right side of the *raphe*, upon the staff, beginning below the *scrotum*, and terminating an inch above the *anus*, in males usually about four fingers' breadth long. If the bistoury did not at first hit upon the groove of the staff, a second cut divided the bulb and a small part of the *pars membranacea urethræ;* the gorget, conductor, or dilator, was then entered on the groove of the staff, the staff drawn back, and the neck of the bladder enlarged with the gorget. The stone-forceps were then passed in, and assisted also in enlarging the neck of the bladder, and with them the stone was grasped and drawn out.

2066. This mode of operating has manifestly great advantage over the little apparatus, but instead of the simple enlargement of the neck of the bladder, as was the object for which it was employed, considerable tearing and bruising was always produced, as experiments on the dead body at least have proved, and pulling out the stone was always accompanied with great difficulty, and injury of the parts. The serious symptoms which mostly followed this mode of operation were, extravasation of blood, abscesses, destroying suppuration, gangrene, fistula, incontinence of urine, and the like. It must not, however, be overlooked that the results with the great apparatus were not exactly so unfavourable, as usually considered to its prejudice; this DESCHAMPS proved, and in reference to the consideration of the several modes of proceeding in the lateral operation, is of very great importance (*a*).

MARESCHAL, by his *coup de maître*, in which, for the purpose of separating the *urethra* from the *anus*, he raised the staff under the pubic *symphysis*, inclined the handle towards himself, and thrust his lithotome further into the *urethra*, endeavoured to give the cut a greater extent; but by this method the *rectum* was always liable to be injured. VACCA BERLINGHIERI's (*b*) treatment, which will be noticed hereafter, resembles this practice.

Upon this mode of operating may be consulted

MARIANA SANCTI BAROLITANI, Libellus aureus de Lapide ex vesicâ per sectionem extrahendo. Venet., 1535.

FIENUS, T., Tractatus de Sectione Calculi, seu Lithotomia.—Wundarzneikunst. Nürnberg, 1675.

FRANCO, P., Traité des Hernies, &c. Lyon, 1561.

PINEAU, S., Discours touchant l'Invention et l'Extraction du Calcul de la Vessie. Paris, 1596.

HILDANI, G. FABRIC., Lithotomia Vesicæ. Basil, 1628.

TOLET, F., Traité de la Lithotomie ou l'Extraction de la Pierre hors de la Vessie. Paris, 1708. Cinq. Edit.

ALGHISI, T., Litotomia, overo dal cavar la Pietra. Florenza, 1707.

GOELICKE, A. O., De optimâ Lithotomiam administrandi ratione. Halæ, 1713.

COLOT, De l'Opération de la Taille. Paris, 1727.

2067. *Cutting for the Stone by the High Operation* (*Apparatus altus, Epicysteotomia, Cystotomia epigastrica*, Lat.; *der hohe Apparat, Bauchblasenschnitt*, Germ.; *le haut Appareil*, Fr.) consists in opening the bladder between the upper edge of the pubic *symphysis* and the fold of *peritonæum*, passing over the bladder. This operation was first per-

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(*a*) CHELIUS, Bemerkungen über den Steinschnitt; in Heidelb. klinisch. Annalen, vol. vi. pt. iv.

(*b*) Della Litotomia nei due sessi, 4th Mem. Pisa, 1825.

formed by **Franco** (*a*) in the year 1561, and he must be considered as the discoverer of the method, although **Archigenes** had previously proposed it. **Rousset** (*b*) closely describes the proceeding, and points out its advantages. It found, however, but little acceptation, on account of the still general opinion of the great danger of wounding the body of the bladder, till it was first again performed in England by **Proby** (*c*); then again brought into some repute by **John Douglas** (*d*), **Cheselden** (*e*), **Prye** (*f*), **Thornhill**, **Macgill** (*g*), **Heister** (*h*), and **Morand** (*i*). The lateral operation, however, soon displaced it; but Frère **Côme**'s (*j*) fortunate experience raised it again for a short time; since then, however, it has been restricted to those extreme cases only in which, on account of the great size of the stone, it could not be got through the lower opening of the *pelvis*. In more recent times it has been performed especially by **Souberbielle**, at Paris, with success; and has been defended by **Carpue** (*k*) and **Home** (*l*). **Scarpa** (*m*), and still more recently, **Dzondi** (*n*), **Belmas** (*o*), **Amussat**, **Baudens**, and **Leroy d'Etiolle** (*p*) have endeavoured in various ways to improve the operation and the instruments.

2068. The following is the mode of proceeding usually employed in cutting for the stone with the high apparatus. The patient lies on a bed covered with a matrass; the *pelvis* a little raised by a pillow beneath it; the lower limbs half-bent at the knee and hip-joints; the head moderately supported so that the abdominal muscles may be relaxed. After the introduction of the arrow sound *(sonde à darde, sonde à flèche)* of **Belmas** into the bladder, and the discovery of the stone, the operator standing on the patient's right side, makes a cut of three inches' length with a convex bistoury, whilst on both sides of the white line he tightens the skin above the edge of the pubic *symphysis* with the fingers of the left hand, exactly in the direction of the white line, through the skin, cellular tissue, and *fascia superficialis*. He now thrusts, immediately behind the pubic *symphysis*, a straight bistoury into the under part of the white line, about an inch deep, and ascertains by the obstruction ceasing, and the fat and loose cellular tissue protruding, that the white line is divided, and the bistoury has penetrated into the space between the pubic bones, the bladder, and the convexity of the *peritonæum*. The point of the left forefinger is now introduced into this opening, the *peritonæum* separated from the wall of the belly, and the wound enlarged upwards by means of a common

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(*a*) Traité des Hernies, contenant, &c., et autres excellentes Parties de la Chirurgie, assavoir de la Pierre, &c., p. 139. Lyon, 1561.

(*b*) Traite Nouveau de l'Hysterotomotokie, ou Enfantement Césarien. Paris, 1581, chap. vii.—**Petrus le Mercier**, Thesis, An ad extrahendum calculum dissecanda ad pubem vesica? Paris, 16 5; in **Halleri** Disputationes Chirurg., vol. iv. p. 985.

(*c*) Philosophical Transactions, vol. xxii. p. 1700.

(*d*) Lithotomia Douglasiana, or An Account of a New Method of making the High Operation. London, 1719.—Lithotomia Douglasiana. London, 1723.

(*e*) A Treatise on the High Operation for the Stone. London, 1723. 8vo.

(*f*) Some Observations on the several Modes of Lithotomy. London, 1724.

(*g*) **Middleton**, A short Essay on the Operation of Lithotomy, as is performed by the New Method above the Pubes; to which is added, A Letter relating to the same subject, from Mr. **Macgill** to Dr. **Douglas**. London, 1727. 4to.

(*h*) De Apparatu Alto. Helmst., 1728.

(*i*) Traité de la Taille ou Haut Appareil. Paris, 1728. 8vo.

(*j*) Nouvelle Méthode d'extraire la Pierre de la vessie urinaire par dessus le pubis, qu'on nomme vulgairement le Haut Appareil, dans l'une et l'autre sexe sans le secours d'aucun fluide retenu ni forcé dans la Vessie. Bruxelles, 1779.

(*k*) A History of the High Operation for the Stone by incision above the Pubes. London, 1819.

(*l*) On a New Mode of performing the High Operation for the Stone; in his Practical Observations on the Treatment of Strictures in the Urethra, vol. iii. p. 359. London, 1821.

(*m*) Sul Taglio epigastrico. Pavia, 1820.

(*n*) Eine leichtere und sichere Weise, den Stein aus der Urinblase zu entfernen; in **von Graefe** und **von Walther**'s Journal, vol. xiv. p. 173.

(*o*) Traité de la Cystotomie suspubienne. Paris, 1827.

(*p*) De la Cystotomie epipubienne. Paris, 18 7.

button-ended bistoury, or by Belmas's buttoned bistoury, introduced on the volar surface of the forefinger, which is to be done rather by pressing the bistoury on, than by a stroke. The operator then grasps the handle of the arrow sound with the right hand, and sinks it, so that the other end rises up immediately behind the pubic *symphysis*, and lifts up the front wall of the bladder like a hillock into the wound; the left finger already in the wound at the same time directing the movement of the beak of the sound, and pressing back the *peritonæum*. The beak of the sound, with the portion of bladder covering it, is now fixed with the thumb and forefinger of the left hand, and the arrow of the sound pushed out by an assistant. A straight bistoury is then thrust upon the groove of the arrow, and the front wall of the bladder cut through from above downwards, the forefinger of the left hand quickly introduced through this wound into the bladder, and its volar surface being directed upwards, and the finger crooked seizes the upper angle of the wound in the bladder, and holds the bladder in a position corresponding to the external wound. If the wound in the bladder do not answer to the size of the stone, it must be enlarged with a button-ended bistoury downwards, towards the neck of the bladder. If the fingers of the right hand cannot seize and draw out the stone, a pair of common stone-forceps may be introduced into the bladder, with which it is easily caught and pulled out, and which may also, if necessary, be assisted by introducing the finger into the *rectum*.

The two most important accidents which may occur in cutting for the stone above the *pubes*, to wit, *wounding the peritonæum*, and *dropping down of the bladder*, at the moment it is cut into, have led to various modes of proceeding in reference to cutting through the coverings and the bladder.

Franco, with his finger introduced into the *rectum*, pressed the stone against the back of the white line, and cut directly upon it. Rousset distended the bladder with a mild fluid to such an extent as to raise it above the *pubes*, and bring it near the wall of the belly. Douglas, Cheselden, and Morand, increased the size and resistance of the bladder, by injecting only moderately, as a greater distension is very painful, and often not possible.

Frère Côme, instead of injection, used the dart sound (*a*), which he introduced through a cut previously made in the membranous part of the *urethra* into the bladder. Loder (*b*) objected to this previous cut in the *perinæum*, and passed the arrow sound through the *urethra* into the bladder; and the same practice was followed by Zang and Home. Zang further advises that the patient should perfectly discharge his urine before the operation; and for the purpose of effecting this more certainly, a small quantity of decoction of mallows may be injected through the catheter into the bladder, and afterwards allowed to escape. Then, if the patient can bear it, a tolerable quantity of the same decoction may be injected gradually into the bladder, which being thus distended, separates the *peritonæum* more from the upper edge of the pubic *symphysis*, and saves it from injury. The *penis* must be tied till the bladder is exposed, and then the dart sound introduced through the *urethra*.

Scarpa gives the dart sound a large sweep and a deep groove, and dips the bistoury a line and a half from its tip into the bladder, more certainly to prevent its slipping off the sound. The large curve of Frère Côme's dart sound easily permits its beak to be thrust against the upper part of the bladder, and by its movement against the pubic *symphysis*, the drawing away also of the *peritonæum*, for which purpose Belmas makes the curve of his instrument shorter and greater, and the further alteration that the beak of the instrument is furnished with a button end, can be protruded further, so that as soon as it is properly introduced into the bladder, the arrow may be pushed forwards. Dzondi uses, as had been done previously by Rousset and Sermes, a catheter grooved on its concave side, which is very safe, if the knife be dipped some lines before the point of the catheter into the bladder. Leroy d'Etiolle has recommended, for raising the bladder, an instrument similar to Heur-

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(*a*) This is a sound of which the tip can be projected by a stilette, and is called by the French *Sonde à dard*, and by the Germans *Pfeilsonde*.

(*b*) Köhler's Anleitung zum Verbande, p. 477.

TELOUP's *percuteur*, with movable branches for that purpose. Many modern Surgeons (BAUDENS, AMUSSAT) object to such instrument for raising the bladder, and pressing it forward, when it has fallen together, and is empty, a proceeding which must always be considered venturesome, as BELMAS's arrow sound, or a catheter properly used, is more safe. DUPUYTREN (*a*), in a case where a small arrow sound was introduced into the bladder, which could not be distended by injection, pressed the stone by assistance from the *rectum*, upwards, and opened the bladder immediately upon it.

The best direction for the external wound is that of the white line. HOME (*b*) made one vertical cut through the skin, above the pubic *symphysis*, a second deeper through the *fascia*, and the belly of the *m. pyramidalis*, and by a third cut made *transversely*, and at a right angle with the first, the insertion of the muscle to the pubic *symphysis*, and the loose cellular tissue on the bladder, and then raised it up with the finger. LE DRAN had previously proposed cutting into the bladder transversely. FRANCK, of Montpellier, also divides two-thirds of the *m. rectus* transversely. According to BAUDENS and AMUSSAT, the cut should be made on the side of the white line, so as to lay bare the inner edge of one or other straight muscle, which done, and the muscle drawn outwards, there is only the thin plate of the transversal *fascia* to be torn through to get at the bladder. BELMAS thinks that the cut should be carried down to the root of the *penis*, to prevent infiltration of urine into that organ; whilst others hold that by such practice an earlier infiltration would be produced.

For cutting into the white line, Frère CÔME used the trocar bistoury and the lenticular bistoury; LEROY a special aponeurotome, and the button-ended bistoury of ROUSSET and BELMAS; SCARPA employed a staff.

The forefinger of the left hand, which is to be introduced as speedily as possible into the bladder when opened, serves best to steady it, and renders the blunt hook, the *gorgeret suspenseur* of BELMAS and LEROY's instrument, unnecessary. The enlargement of the wound in the bladder must be made when the size and condition of the stone has been decided by the introduction of the finger, in which case, by the yielding of the edges of the wound in the bladder, a small cut is sufficient for the removal of a large stone. DZONDI also proposes raising the stone into the wound by means of a button fixed upon the beak of the catheter, and to enlarge the wound if its edges offer much obstruction. HOME has recommended a particular kind of forceps with a net (*c*).

2069. When the stone has been drawn out, the bladder carefully examined with the finger, and the wound cleaned, the end of a piece of half unravelled linen should be passed through the wound into the bottom of the bladder, but SCARPA thinks it better merely to insert it in the space between the bladder and abdominal muscles, leaving its end hanging out of the lower angle of the wound. The wound is to be covered with lint and compress, and the whole dressing fastened with a linen belly-bandage.

When an opening is first made into the *pars membranacea*, a silver or elastic catheter, for the escape of the urine, must be introduced, and properly fastened (Frère CÔME); by which, however, the urine does not escape more easily nor in larger quantity than from a catheter introduced into the *urethra* (HOME, ZANG.) SOUBERBIELLE (*d*) employs merely a dressing covering the outer wound, and for the purpose of drawing away the urine from the wound an elastic catheter, at least eleven inches long, much curved like an **S**, and furnished with several openings along its beak; to its outer end a second tube of similar length is closely and firmly attached, so as thus to make a perfect syphon. SEGALAS drew some threads of cotton through the whole length of an elastic catheter, so as to hang out at both the side openings, and at the mouth of the catheter (*e*). By CLOQUET's attracting catheter (*sonde aspiratrice*) the urine is well drawn off; and AMUSSAT has endeavoured to improve it by an elastic tube curved, with an olive-shaped beak, having side openings, and at the mouth furnished with a spout, to which a pig's bladder may be attached.

With the same view, to wit, the prevention of the infiltration of urine, it has been proposed, first only to make a cut into the lower part of the white line, to introduce a rod, having its front end bent at a right angle, by which the bladder can be fixed against the back of the white line, till adhesion is effected; and, three or four days

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(*a*) Leçons orales de Clinique Chirurgicale, vol. ii. p. 366.

(*b*) Above cited, p. 359.

(*c*) Above cited, p. 382.

(*d*) Observations sur les Opérations de Cystotomie suspubienne pratiquées sur l'homme et sur la femme; in Journ. Génér. de Médec., vol. cv. p. 274. 1828, Nov.

(*e*) FRORIEP's Chirurg. Kupfertaf., pl. 318.

after, to cut into the bladder within the bounds of this adhesion (Vernieres); or to operate at two intervals, first to cut through the parts to the bladder, then three or four days after to open the bladder, when the surrounding cellular tissue has become firm and impenetrable to the urine (Vidal de Cassis.) Here, also, may be mentioned the union of the wound of the bladder by suture, (Solingen, Gehler,) in reference to which Pinel Grandechamp instituted experiments on animals (*a*), from whence he concludes that the danger of the high operation may be diminished.

2070. For some little time after the operation, the dressings must be changed twice or thrice a day, during which time all the urine escapes through the wound in the belly, and passes between the pieces of the dressing. After three or four days, the strips of linen may be taken away, as then the swelling of the edges of the wound and of the cellular tissue between the bladder and walls of the belly is so great that the urine cannot infiltrate. The water now begins to flow gradually through the *urethra*, in proportion as the passage through the wound narrows, and at last it closes with simple treatment.

Dupuytren (*b*) considers all precautionary rules to keep the urine entirely away from the wound above the pubic *symphysis* as fruitless, the approximation of the edges of the wound by the stitch openings through the *perinæum* and *rectum*, and the introduction of the catheter through either of them, or through the *urethra*, of no use, and sometimes even dangerous, as they may produce infiltration of urine, and inflammation of the *peritonæum*, and of the cellular tissue in the cavity of the *pelvis*.

2071. The untoward circumstances which may arise during and after this operation are,—great difficulty in its performance, on account of the bladder becoming much contracted; wounding the *peritonæum;* protrusion of the intestines from the opening, and flow of urine into the cavity of the belly; violent inflammation of the *peritonæum;* infiltration of the urine into the cellular tissue, abscess, and gangrene. When the contracted bladder is very deep, the operation must be performed with the greatest care; and it must be specially remembered that the front wall of the bladder must be cut into, not above the pubic *symphysis*, but behind it. If the *peritonæum* be wounded, the opening must be at once closed with a sponge. This is the most serious accident; but not always does there occur fatal extravasation of urine into the cavity of the belly (Douglas, Frère Côme, Souberbielle.) Zang (*c*), in cases of injury of the *peritonæum*, recommends for completely drawing off the urine, the puncture of the bladder through the *rectum*, and, in women, by the *vagina;* a proceeding which Deschamps(*d*)has generally practised, and, for the more safe performance of the puncture, recommends a hollow cylinder with a handle, which is brought through the wound in the bladder, and, by the trocar, introduced into the *rectum*, the hind wall of the bladder is thrust into the cylinder, and may be there perforated. The inflammation to be feared after the high operation for the stone must be prevented and got rid of by suitable antiphlogistic treatment, as in the lateral operation. Infiltrations of urine and abscess require the use of the knife, and such posture as will prevent the collection of urine and of pus. In this respect it is most important that the operation should be performed with the greatest possible care and dexterity, so that the cellular connexions of the bladder be not very much torn, nor separated to a great distance.

Pallucci practises thrusting a trocar from the bladder outwards, near its neck, so that there may be an opening in the *perinæum* by the side of the *anus*, into which a canula should be inserted for the discharge of the urine.

(*a*) In Ollivier, above cited, p. 74.

(*b*) Leçons orales de Clinique Chirurgicale, vol. ii. p. 361.

(*c*) Above cited, p. 274, pl. i. ii. f. 6.

(*d*) Above cited, vol. iv. p. 113, pl. viii.

2072. If the advantages and disadvantages of cutting for the stone above the pubic *symphysis* have to be critically reviewed, this can only be done from the results which Douglas, Cheselden, Frère Côme, and Souberbielle, have kept, without distinction, of the operations they performed on a certain number of patients, both men and women, with small and large stones. These results are but little distinguished from those of the lateral operation. Bleeding is not at all to be feared in this operation; very large stones especially may be removed by it; and palsy of the bladder is never consequent to it. In our days, however, this mode of operation is mostly confined to those cases in which the lateral operation is not proper, on account of disease of the neck of the bladder and of the prostate gland; also in very large stones, which are ascertained to be so previous to operation, or during the performance of the lateral operation; and when, on account of peculiar crippling of the lower limbs, the *perinæum* cannot be well got at. It must, however, be remarked, in reference to the large size of the stone, that if it entirely fill the contracted bladder, if the walls of the bladder be very thick, and the like, cutting for the stone above the pubic *symphysis* is very difficult, and may be even impossible, because the arrow sound cannot be raised up between the stone and the bladder, or the thickened and contracted bladder cannot be pushed up behind the pubic *symphysis;* and in such cases, especially on account of the organic changes in the bladder, the operation in general causes the death of the patient (*a*).

[The following is the interesting notice left by Cheselden of the revival, as well as of the disuse, of the high operation in his time:—"In the year 1717-18 Dr. James Douglas, in a paper presented to the Royal Society, demonstrated from the anatomy of the parts, that the high operation for the stone might be practised; which had been once performed by Franco injudiciously, and by him disrecommended, though his patient recovered; and afterwards strongly recommended, but not practised, by Rosset. Yet no one undertook it, till his brother Mr. John Douglas, about three years after, performed it, and with great applause, his two first patients recovering. Soon after, a Surgeon of St. Thomas's Hospital cut two, who both recovered; but the same gentleman afterwards cutting two, who miscarried by the cutting or bursting of the *peritonæum*, so that the guts appeared, this way immediately became as much decried as it was before recommended; upon which the Surgeons of St. Bartholomew's Hospital, who had prepared to perform this operation, altered their resolution, and went on in the old way. The next season, it being my turn (*b*) in St. Thomas's, I resumed the high way, and cutting nine with success, it came again in vogue. After that every lithotomist of both hospitals practised it; but the *peritonæum* being often cut or burst, twice in my practice, though some of these recovered, and sometimes the bladder itself was burst, from injecting too much water, which generally proved fatal in a day or two. Another inconvenience attended every operation of this kind, which was, that the urine's lying continually in the wound retarded the cure; but then it was never followed with an incontinence of urine. What the success of the several operators was, I will not take the liberty to publish; but for my own, exclusive of the two before mentioned, I lost no more than one in seven, which is more than any one else, that I know of, could say; whereas, in the old way, (cutting on the gripe,) even at Paris, from a fair calculation of above eight hundred patients, it appears that near two in five died. And though this operation came into universal discredit, I must declare it my opinion, that it is much better than the old way, to which they all returned, except myself, who would not have left the high way, but for the hopes I had of a better; being well assured that it might hereafter be practised with greater success; these fatal

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(*a*) Scarpa in Ollivier, above cited, p. 70.—Hunauld, Dissert. Recherches comparatives sur la Lithotomie. Paris, 1824.

(*b*) This expression, "my turn," alludes to an old regulation at St. Thomas's, and I believe most other hospitals, by which each of the Surgeons was directed to operate on all the stone cases admitted during a certain number of months, alternately; it being supposed that the Surgeon would operate better for having "his hand in," than if he had merely his own cases. At our hospital this arrangement still existed when I was first a student, but it was given up in 1814; after which time every Surgeon operated on his own cases.

accidents having pretty well shown how much water might be injected, and how large the wound might safely be made."—(pp. 327, 28.)]

2073. The *Lateral Operation for the Stone* (*Sectio lateralis, Cystotrachelotomia*, Lat.; *der Seitensteinschnitt*, Germ.; *la Taille latérale*, Fr.) is at present the most usual method of operating, independent of the various modes of proceeding by which its several acts are performed. It is generally characterised by a cut made in the *perinæum*, extending from the side of the *raphe* towards the ischial tuberosity between the *m. erector penis* and *accelerator urinæ*, by which the membranous part of the *urethra* is opened, and the neck of the bladder, the prostate gland, and part even of the body of the bladder, are cut into.

2074. History names FRANCO as the inventor of this method, although it was first brought into use by Frère JACQUES BEAULIEU, at the end of the seventeenth century. MERY improved it. In Holland, RAU, who had learned this operation from BEAULIEU himself, practised it with the greatest success; but he never made anything known of his practice, and therefore opinions were divided about it (1). HEISTER seems to have first rightly determined it; and CHESELDEN, after fruitless attempts to make out RAU's method, which he wrongly thought consisted in opening the body of the bladder, was led to his own particular method.

LE DRAN, LE CAT, Frère CÔME, HAWKINS, GUERIN, PAYOLA, and others, have especially modified the necessary instruments, and more recently LANGENBECK, KLEIN, and DUBOIS, have contributed to the simplification of the operation.

[(1) RAU's experience must indeed have been very large, for ALBINUS (*a*), quoting from an oration (*b*) of RAU's, says that he "*performed his operation on fifteen hundred and forty-seven men*, and that he continued to perform it frequently up to his death." ALBINUS states:—"There was undoubted proof that RAU at first treated stone-patients in Holland by opening the *urethra* in the *perinæum*, with the great apparatus, which he had certainly learned at Paris. It is also sure that he not only saw Frère JACQUES operate, but that he several times examined the bodies of persons who had died after these operations. But afterwards he always practised a new method of his own, by which he cut into the same place as the monk had.

"In this operation it was proposed, neither to cut into the neck of the bladder, as was first done, nor into the *urethra*, as at that time most were accustomed to do, but into the bladder itself, close to its neck, on the side, and somewhat towards its lower and back part; which section of the bladder could not in itself be much more dangerous than that of the neck or of the *urethra*. And as thus the *urethra* and neck of the bladder remained entire, and these necessarily narrow passages, and very delicate parts were injured, neither by the introduction of instruments, nor withdrawing them with great violence, nor by extracting even the stone, oftentimes large, rough, and pointed, violently and cruelly, and as much which usually happened, and very great evils were avoided, it seemed far to exceed the ordinary methods." ALBINUS then notices the dangers and difficulties attendant on the operation, and which, he says, "he had read and heard often happened to Frère JACQUES, who neither understood the structure nor situation of the parts, nor had any certainty by which he could guide the knife and forceps. It therefore needs only when we would praise his method, that we should not hesitate openly to affirm it was rather practised by him with great loss of mankind, and to the destruction of the patients, and that it would have been better he should never have thought of it, had it not given RAU the opportunity of discovering the best mode. For he, when clearly acquainted with the structure and situation of those parts which were to be cut into or avoided, considered nothing was wanting to this method, than that a plan should be found by which instruments might be immediately and certainly directed to that part of the bladder; this he discovered, and most successfully practised. It cannot indeed be denied that Frère JACQUES preceded RAU; but to RAU now and for ever is due the greatest praise

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(*a*) Index Supellectilis Anatomicæ quam Acad. Batav. quæ Leidæ est legavit vir clarissimus JOHANNES JACOBUS RAU, &c., confectiis a B. S. ALBINO, qui vitam ejus et curationem quam Calculosis adhibuit instrumentorum que figuras addidit. Ludg. Bat., M.DCC.XXV.

(*b*) Quære, That *De Methodo Anatomen Docendi et Discendi*, delivered in 1713, on the day of his reception as Professor of Physic, Anatomy, and Surgery, in the University of Leyden? I am unaware of any other.—J. F. S.

and glory, that by his own skill, ingenuity, and industry, he made that addition by which alone treatment, otherwise uncertain, dangerous, and even hurtful, was rendered sure, safer, much better, and more excellent than others. He added the catheter, as it is called, which he had deeply grooved on its curved side; this he passed by the urinary passage into the bladder, and applied its convexity to that part of the bladder which was to be cut, so as to enable him to find it externally, to make the cut through the skin upon it, to direct the knife towards it, to cut the bladder upon it with certainty, and to introduce the forceps directly, just as was wont to be done by the great apparatus." Not considering the common catheter sufficiently curved, Rau had "the curve of his made a little greater at the termination of its straight part and the beginning of the groove, and at the end of the curve the beak was made straighter and longer, so that the knife might be carried backwards upon it, and a sufficiently large wound made in the bladder." Having introduced the catheter, he so placed it that "its grooved curve resting near the neck, was applied to that part of the bladder to be cut, on the left side, and a little below and behind the neck; which done, the catheter was gently pressed on that part, and the thumb moved externally over the soft part of the buttock, to the left of the *anus* between it and the great tuberosity of the haunch-bone. Then gently inclining the catheter towards his right thumb, which he pressed from the right and upwards, he found externally, and noted the spot opposite the curve of the catheter, at which the first cut was to be. This was made on the left of the *anus*, about a thumb or two fingers' breadth from it towards the ischial tuberosity, not nearer, lest the *rectum* should be wounded; nor farther from it, lest the knife should need be thrust too obliquely towards the catheter. * * * The spot found, he first divided merely the skin and a little of the fat, with a straight cut of sufficient length, from above downwards and outwards, that is towards the ischial tuberosity, so as to get away from the *rectum;* but he did not take much trouble about this wound. He then passed his right thumb or forefinger into the wound, with his nail towards the catheter, which was kept as closely as possible to that part of the bladder to be cut into, again seeking for that instrument, and having found it, he withdrew his thumb and carefully carried in the point of his knife, not, however, too high, and cautiously directed it towards the catheter, which he had just before found with his thumb, and then gently cut through whatever he met. In order that he might not easily wound the *rectum*, he in general first gently passed his finger into it, so that he might ascertain its position and avoid it. When by thus cutting gently he had nearly reached the bladder, he passed the thumb or forefinger into the wound, again seeking for the catheter, and replacing it if disturbed by the patient tossing about. * * * Keeping the catheter applied on the left to the part to be cut, he then carried the knife cautiously from the right through the wound, not cutting with it, but that its point might directly reach the catheter. He then attentively and cautiously thrust the point of the knife into the groove of the catheter; and when he knew by the feel that the point of the knife and the catheter touched, and by moving it gently on either side, that then it was retained within the groove, then moving the knife carefully and firmly up and down, he cut rather downwards, and cautiously accommodating the catheter to the knife, he cut into the bladder with a moderate-sized wound, which he made to descend from above outwards by placing the catheter, which was obviously necessary to prevent injury of the neighbouring parts. He then took care that the catheter should not recede from the wound in the bladder, and having introduced his finger, generally discovered the extent of the wound and the naked catheter; especially if he thought it had moved its place, it being necessary that the groove of the catheter should be bare at the wound of the bladder, so that the male conductor might be without doubt passed into it. When all was again right, he took the male conductor with his right hand, and attentively, carefully, and steadily pressed it forwards, so that it might enter the groove of the catheter without being intercepted, which the resistance and hardness of the latter informed him of. Being thus assured, he thrust the conductor much to the right, and drew back the catheter in proportion, at the same time gently inclining its handle to the left. The object of thus doing was that the curve of the catheter might escape from the wound of the bladder into its cavity, and at the same time the conductor still resting in the groove of the catheter, and pushed forwards might more safely and certainly enter the cavity of the bladder. He then moved the conductor gently about, and if he found the bare catheter, and especially the stone, he more certainly knew that it rested in the cavity of the bladder. The rest of the operation was performed, as with the great apparatus; for the right hand held the male conductor in the bladder, the left withdrew the catheter from it by the *urethra;* then the left hand grasped the male conductor, and the right carried the female, guided by the male, into the bladder. He then cleverly held both conductors apart with the fingers of the left hand,

and with the right pressed the forceps between them directly into the bladder, and withdrew the female conductor. He then sought for the stone with the forceps, and having found it, was certified that the forceps had not gone wrong, but were in the bladder, and withdrew the male conductor. He then opened the forceps somewhat and sufficiently both to enlarge the wound and dilate the bladder as much as possible to separate it from the stone. Finally, he searched for, seized and extracted the stone, using the same precautions as those are accustomed and ought to use, who well perform this cure by cutting into the *urethra* in the *perinæum.*"

Such is the account, not very clear, certainly, which Albinus has left of Rau's operation, but important as being the first which was grounded on anatomy, and not merely empirical. It also led Cheselden to give up the high operation; for, "hearing," says he, "of the great success of Mr. Rau, professor of anatomy at Leyden, I determined to try, though not in his manner, to cut directly into the bladder; and as his operation was an improvement of Friar Jacques', I endeavoured to improve upon him by filling the bladder, as Douglas had done in the high way, with water, leaving the catheter in, and then cutting on the outside of the catheter into the bladder in the same place as upon the gripe, which I could do very readily, and take out a stone of any size with more ease than in any other way. My patients, for some days after the operation, seemed out of danger, but the urine which came out of the bladder, continually lodging upon the cellular membrane on the outside of the *rectum*, made fetid ulcers, attended with a vast discharge of stinking matter; and from this cause I lost four patients out of ten. * * * I then attempted to cut into the bladder in the same manner that Mr. Rau was commonly reported to do, but there had the same inconvenience from the urine's lodging upon the cellular membrane on the outside of the *intestinum rectum.* Upon these disappointments I contrived the manner of cutting which is now called the lateral way." (p. 328-30.)]

2075. The preparation for this operation consists in clearing the *perinæum* of hair, and in emptying the *rectum* by a clyster. The patient is placed on a table covered with a firm matrass, in a horizontal, and by some in a rather reclined posture, with his head supported by pillows. The ischial tuberosities should project a little beyond the edge of the table. The hands are attached by bandages to the feet, which are drawn up. In children, also, especially, who are generally very difficult to hold in the operation, it is advantageous to bind the body with a broad cloth to the table (1). Two assistants grasp the feet, so as each to press a knee with one hand against their breast, and with the other placed on the inside of the foot, to hold it out, and to separate the thighs moderately from each other; a third assistant fixes the *pelvis*, and a fourth hands the instruments to the operator (2).

[(1) The direction here given of fixing a child to the table with a bandage is very objectionable on account of the pressure it must make upon the chest and its interference with his breathing. It is also wholly unnecessary, if the assistants know how to hold the patient and do so properly.

(2) Trifling as it might at first seem, the holding a patient properly and steadily during the operation for the stone, is a most important part of the proceeding, and is of material advantage or disadvantage to the operator, as it is well or ill done. The patient ought to be, and may be, without difficulty, so effectually fixed, that when once placed he cannot move. The knees should always be kept as far apart as possible, and the heels close upon the outside of the great trochanters, by which the operator has ample room for the use of his instruments. The best mode of effecting this is by the assistant fixing the patient's knee deeply in his own armpit, and then dropping his upper arm vertically on the inside of the bound limb, he hugs it closely to his own chest, and if the patient be powerful and resisting, the assistant throws the weight of his body upon the knee, and thus easily inclines it outwards. The fore-arm and hand being at liberty, are placed on the inside of the leg, to assist the other hand of the assistant, which should grasp the foot, either across the instep or the middle of the sole, and bear it outwards. This is the easiest and least fatiguing mode of fixing, both to patient and assistants, and but rarely requires any correction during the operation. The neck ligature, consisting of a bandage round the neck, carried from within outwards at the bent hams, and tied upon the neck, adds much to steadying the patient, and is always

advantageous; care should, however, be taken to insert a pad between the neck and the bandage, otherwise the former will be unnecessarily wrung.

In the operation for the stone it should also be specially remembered that handkerchiefs should be removed, and shirt-collars opened at the throat, or the patient, in his struggles, may be choked, or at least much distressed; and in holding him the assistants should be careful not to make any pressure upon the chest.

There is no necessity for special fixing the *pelvis* beyond that which the two assistants, standing on either side, are capable of; but if the patient be very powerful and restless a third assistant may fix his shoulders, by standing behind and grasping them with either hand.—J. F. S.]

2076. The operation itself consists of the following acts:—α. the introduction of the staff; β. the cut through the skin and muscles; γ. opening the membranous part of the *urethra*; δ. cutting into the neck of the bladder; ε. the drawing out the stone.

2077. The *staff is to be introduced into the bladder*, after having been oiled, in the same way as the catheter; the presence of the stone is at once ascertained with it; but the operation should be put off if it cannot be distinctly felt. The staff must be held by an assistant, who, atthe same time lifts up the *scrotum*, either quite straight or inclined a little towards the right side, or the operator himself holds it with his left hand (*a*). As the introduction of the staff, after the patient is put in the posture directed, is often very difficult, it may be passed before the person is bound.

[Brodie mentions a remarkable instance of this kind which occurred to him:—"The stone could sometimes be felt distinctly with the sound, appearing to be of large size, while at other times it could not be felt at all; and sometimes when the bladder was empty of urine, it could be perceived distinctly with the finger from the *rectum*; while at other times, when there was urine in the bladder, it could not be detected at all by this mode of examination. In performing the operation," says he, "when I had introduced my finger into the bladder, I could at first discover no stone. At last I felt it on the anterior part of the bladder, behind the *pubes*. It was not lying loose in the cavity of the bladder, but evidently contained in a cyst, communicating with the bladder by a round opening. By means of a probe-pointed bistoury, I carefully dilated the orifice of the cyst, and then introducing my finger, separated the membrane of it from the *calculus*, until I was enabled to take hold of the stone with the forceps. It was not only encysted but adhering also, for it was brought away with a portion of the membranous lining of the cyst closely attached to it. The boy recovered." (p. 323.)

Without the stone being encysted, I have frequently known it impossible to find the stone by the most careful sounding for many months, although the symptoms have been so severe as almost to preclude the possibility of doubting its existence. I recollect one instance where the stone was not found for nearly eight years, but was then struck, and the boy, at that time thirteen years old, was operated on successfully.—J. F. S.]

2078. The *cut through the skin and muscles* is commenced, in adults, from twelve to fifteen, in young people, from nine to twelve, in boys, from six to seven, and in children, five lines above the *anus*, on the left side of the *raphe*, some lines distant from it, and carried rather obliquely from above downwards, parallel with the ascending branch of the haunch-bone, and at proper distance from it to the middle of a line supposed to be drawn from the *anus* to the ischial tuberosity. The first stroke of the knife divides the skin and underlying cellular tissue, and a second, extending not quite so low, cuts through the *m. transversus perinæi* completely, and the *m. levator ani* partially. If by this the membranous part of the *urethra* be not laid bare, so that the groove of the catheter can be distinctly felt by the forefinger of the left hand, that finger is to be placed with its volar surface towards the patient's right side, at the upper angle

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(*a*) Dupuytren, above cited, p. 15.— Dubois, Propositions sur diverses parties de l'Art de guerir. Paris, 1818.

of the wound, and near to it the part still covering the membranous part are to be divided. At this place I generally press the bistoury on to the staff, thrusting it in the direction as if I would push it up behind the pubic *symphysis*, and then complete the cut by carrying the knife downwards (1).

If the outer cut be begun higher than directed, there is danger of wounding the bulb of the *urethra*, and the transverse artery of the *perinæum*. Continuing the cut lower endangers either the *rectum*, or, if the cut be made too much outwards, the internal pudic artery.

Rheineck (*a*) always makes the cut on the *right* ride, which has no advantage, and is only proper if the patient must be cut on the right side (*b*), which may be the case if the *rectum*, instead of being directly behind the prostate, be on its left side (*c*).

[Brodie directs that the staff be "held nearly perpendicularly, the handle of it being, however, a little inclined towards the patient's right groin. This causes the convexity of the instrument to project slightly on the left side of the *perinæum*. In the first part of the operation, your attention is to be directed to the staff. You are to feel it with your left hand, and the knife, held in your right hand, is to be directed towards it. It is a sure guide, following which, you can never err, even in the deepest *perinæum*. * * * Where there is any quantity of fat in the *perinæum*, or anything even distantly approaching to what we call a deep *perinæum*, if you attempt to cut at once into the groove of the staff, the result is, that you open the *urethra* too far forwards; you divide the *corpus spongiosum* of the *penis*, which need not in reality be divided at all; and you are then certain of wounding the artery of the bulb of the *urethra*, which otherwise is in most instances avoided. Another inconvenience which attends on this method of proceeding is, that the wound being too near to the *scrotum*, the cellular membrane of it is in danger of being infiltrated with blood; and another still is, that a greater mass of substance is left to be divided, when you continue the incision into the bladder, than there would have been if you had cut into the *urethra* further back in the first instance. I say, then, let the opening in the *urethra* be made deep in the *perinæum*, behind the bulb, and as near as can be to the prostate. Place the thumb of your left hand on the skin over the staff; and in a man of ordinary size, about an inch and a quarter before the *anus*. Begin your incision immediately below this, on the left side of the *raphe*, and continue it backwards and towards the left side, into the space between the *anus*, and the tuberosity of the left *ischium*. Here you may cut freely; you can injure nothing of consequence. Then feel for the staff in the wound; direct the point of your knife towards it, and carefully cut into the groove, where it lies in the membranous part of the *urethra*. All these incisions are made low down in the *perinæum*, that is, near the *rectum*." (pp. 309, 10.)

A free cut through the skin, proportioned to the patient's size, is always very advantageous, as it materially facilitates the withdrawal of the stone, if it be large, and prevents much bruising, which is an object of great importance. I have seen both small and large external cuts made, and am sure that the latter are preferable to the former, although I am not inclined to make the cut so large as to be able to see through it into the bladder, as was jokingly said of the operations of Chandler, who was a very good and quick lithotomist, and one of the Surgeons at St. Thomas's Hospital during my studentship. It is not the first cut which can wound the *rectum*, except with excessive carelessness, but the second, and then it may easily be prevented if the Surgeon keep the point of his knife raised towards the pubic arch, instead of depressing it towards the *rectum*, as is too frequently done.—J. F. S.]

2079. The *opening of the membranous part of the urethra*, and the *cutting into the neck of the bladder*, is that act of the operation by which the several modes of performing the lateral operation for the stone are distinguished. These may be arranged under the following divisions:—*First*, the cut into the neck of the bladder made with the same knife used for the outer cut; *Second*, with some special instrument for the purpose, and from without inwards; *Third*, with a special instrument from within outwards.

(*a*) Medic. und Chirurg. Betracht. über die einfache Methode des Seitenblasenschnittes; mit einer Vorrede von C. L. Mursinna. Berlin, 1815.

(*b*) Klein; in Loder's Journal, vol. iv. p. 255.

(*c*) Deschamps, above cited, vol. iii. p. 89, Obs. 168, 169.

[Scarpa (*a*) has made the following important observations in reference to the division of the prostate in the lateral operation, whether performed with the knife or with the gorget:—" As the apex of the prostate gland forms the greatest resistance to the introduction of the forceps and the extraction of the stone, this part of it ought, in every operation of lithotomy in the *perinæum*, to be completely divided. But with respect to the body and base of the gland, an incision, extending to the depth of five lines, through its whole length, and consequently including a small portion of the orifice of the bladder, is, with the aid of a moderate and gradually increased dilatation, sufficient for the extraction of a stone of more than ordinary size, without the parts through which it passes being greatly contused or lacerated. In children, where the orifice of the bladder and base of the prostate gland are easily distended, and in aged persons, in whom the orifice of the bladder, and neck of the *urethra* are generally much larger than in adults, an incision in the base of the gland less than five lines in depth, and in children, of two only, is sufficient for the extraction of a stone of ordinary size, by means of a moderate dilatation of those parts. The large size of the stone, for instance, of one exceeding twenty lines in its smallest diameter, is no sufficient ground for dividing the substance of the gland to such an extent as to penetrate into the cellular membrane beyond it and the *fundus* of the bladder; for as an incision of such depth is constantly followed by the infiltration of urine, gangrenous abscesses, and *fistulæ*, between the bladder and *rectum*, it is obvious that *calculi* of such size ought never to be extracted by the *perinæum*. The lateral operation has therefore limits beyond which it is impossible to pass without exposing the patient to more serious evils than those which could arise from the presence of the stone in the bladder." (p. 7-9.)]

2080. *The cut into the neck of the bladder made with the same knife.* To this belong the methods of Franco, Frère Jacques, Rau, Cheselden, Morand, and others, and as it has been more or less modified and employed in recent times by Dubois, Klein, Langenbeck, and Kern. When the outer cut is made, and the membranous part laid bare, either the point of the bistoury is introduced on the nail of the left forefinger, which rests on the groove of the staff, into it, or the point of the knife is thrust directly into the groove of the staff, behind the top of its curve, also behind the *symphysis*, in a direction as if it were to come out at the first lumbar *vertebra*. The staff is now taken with the left hand from the assistant, brought in a parallel direction to the *linea alba*, pressed towards the *symphysis*, and the knife, held with the whole hand, is thrust into the groove of the staff, according to the direction of the outer wound, up to the blind end of the staff, and then in drawing out the knife, its handle being a little raised, the inner cut is enlarged. A common somewhat convex bistoury serves the purpose in this method, but the most suitable is a particular knife, the convex blade of which is connected firmly with a rather long handle, as the knives of Cheselden (*b*) and Dubois (*c*).

Le Dran (*d*), after having made the cut through the skin and *urethra*, introduced a director with a beak (*sonde à bec*) upon the groove of the staff into the bladder, and having withdrawn the staff, examined the stone with the director to ascertain its size, and then thrust a convex bistoury (*bistouri à rondache*) into the bladder upon the groove, turned downwards, of the director. Daunt's method is similar, in which, after opening the membranous part of the *urethra*, and introducing a director, or lithotome furnished with a tongue, was pushed in sideways (Dease) (*e*). In a similar manner, Mütter (*f*) operates; after opening the membranous part, another staff is introduced upon the former, and with it a sickle-shaped knife, and in drawing the knife out, the neck of the bladder is cut into.

Pouteau's (*g*) is a modification of Le Dran's method. Key (*h*) employs merely a staff with a very short curve, and a convex bistoury (1).

(*a*) Memoria sul conduttore taglienti d' Hawkins per l'estrazione della Pietra della Vesica. Pavia, 1825. Translated by Briggs.

(*b*) Douglas, Appendix to the History of the Lateral Operation for the Stone, containing Mr. Cheselden's present method of performing it. London, 1731.

(*c*) Above cited.—Chelius's alteration of Dubois' knife; in Wehr, Dissert. de Lithotomiâ laterale. Heidelberg, 1836.

(*d*) Traité des Opérations, p. 307. Paris, 1742.

(*e*) Essay on Hydrocele.

(*f*) Practical Observations on the Lateral Operation of Lithotomy, and on the various and new modes of performing this Operation, &c. New York, 1824; with plates.

(*g*) Taille au niveau. Avignon, 1765, pl. i. ii.

(*h*) A short Treatise on the Section of the Prostatic Gland in Lithotomy, &c. London, 1824. 4to.; with plates.

Klein's (*a*) method is peculiarly distinguished by his using a common bistoury, and he *not only always cuts completely through the prostate gland, but always also the bladder itself.*

von Kern (*b*) places the nail of the left thumb in the groove of the staff, and retains it there whilst he carries the knife to the blind extremity of the staff.

Guérin's (*c*) method may be here mentioned, which, however, has but historical interest.

[(1) Key's *operation* (*d*) is performed with a straight staff, of which the point is curved slightly upwards to the extent of an inch, so as to avoid its catching in any projecting fold of the bladder, and its groove deeper than in the common staff, to prevent any risk of the knife slipping out. His knife, in form, resembles a common scalpel, but is longer in the blade, and slightly convex in the back near the point, to enable it to run with more facility in the groove of the director.

Operation.—"An assistant holding the director with the handle somewhat inclined towards the operator, the external incision of the usual extent is made with the knife, until the groove is opened, and the point of the knife rests fairly in the director, which can be readily ascertained by the sensation communicated; the point being kept steadily against the groove, the operator with his left hand takes the handle of the director, and lowers it till he brings the handle to the elevation described in Pl. iii.,* keeping his right hand fixed; then with an easy simultaneous movement of both hands, the groove of the director and the edge of the knife are to be turned obliquely towards the patient's left side; the knife having the proper bearing is now ready for the section of the prostate; at this time the operator should look to the exact line the director takes, in order to carry the knife safely and slowly along the groove, which may now be done without any risk of the point slipping out. The knife may then be either withdrawn along the director, or the parts further dilated, according to circumstances. Having delivered his knife to the assistant, the operator takes the staff in his right hand, and passing the forefinger of his left along the director, through the opening in the prostate, withdraws the director, and exchanging it for the forceps, passes the latter upon his finger into the cavity of the bladder. In extracting the *calculus*, should the aperture in the prostate prove too small, and a great degree of violence be required to make it pass through the opening, it is advisable always to dilate with the knife, rather than expose the patient to the inevitable danger consequent on laceration." (p. 28-30.)

Liston (*e*) uses a curved staff, and a long straight knife slightly convex towards its point. He "enters the knife freely into the *perinæum*, about an inch more or less behind the *scrotum*, and makes it cut downwards and outwards through the skin and superficial *fascia*, in a line about midway betwixt the tuberosity of the *ischium* and the *anus*, and beyond that orifice towards the sacro-ischiatic ligament. The forefinger of the left hand is then placed in the bottom of the wound, about its middle, and directed upwards and forwards; any fibres of the transverse muscle or of the *levator* of the *anus* that offer resistance, are divided by the knife, with its edge turned downwards; the finger then passes readily through the loose cellular tissue, but is resisted by the deep *fascia*, immediately anterior to which the groove of the staff can be felt thinly covered. The point of the instrument is slipped along the nail of the finger, and, guided by it, is entered into the groove at this point, with its back still directed upwards. The finger all along is placed so as to depress and protect as much as possible the coats of the *rectum*. The same knife, pushed forwards, is made to divide the deep *fascia*, the muscular fibres within its layers, and a very small portion, not more than two lines, of the *urethra* anterior to the apex of the prostate, together with the prostatic portion of the canal and the gland, to a very limited extent. The external incision cannot be too free within certain bounds * * * But the internal incision must be very limited indeed; it should certainly not extend beyond six or seven lines from the *urethra*, outwards and downwards; for the less that is cut, the greater will be the patient's safety. * * * The object in following this method, is to avoid all interference with the reflection of the ilio-vesical *fascia*, from the sides of the

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(*a*) Chirurg. Beobacht., p. 1. Stuttgart, 180[illegible].—Praktische Ansichten der bedeutendsten Operationen, pt. ii. Stuttgart, 1816.

(*b*) Above cited.

(*c*) Mémoire sur l'Opération de la Taille; in Recueil des Actes de la Société de Lyon, p. 390, vol. ii. 1801.—Treyeran, Parallèle des diverses Méthodes proposées pour l'extraction des Calculs vésicaux par l'appareil latérale &c. Paris, 1802.—Chrestieen, Dissert. de Nova Lithotomia Guerini. Erlang, 1804.—Michaelis, Etwas über den Blasensteinschnitt. Marburg, 1813, tab ii.—Klein, Ueber Guérin's Instrument zum Blasenschnitt; in Chiron., vol. ii. part ii. pl vi. f. 1-6.—Montagna; in von Graefe und von Walther's Journal vol. iv. p. 507, pl. vi. f. 3-6.—Smith, in Baltimore Med. and Surg. Journ. and Rev. 1834, April, p. 13.

(*d*) Short Treatise, above cited.

(*e*) Practical Surgery. Fourth Edition.

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* This is the only direction laid down as to the position of the staff, and I am sorry I am unable to give it more precisely.—J. F. S.

pelvic cavity over the base of the gland and side of the bladder. If this natural boundary between the external and internal cellular tissue is broken up, there is scarcely a possibility of preventing infiltration of urine, which must almost certainly prove fatal. The prostate and other parts around the neck of the bladder are very elastic and yielding, so that without much solution of their continuity, and without the least laceration, the opening can be so dilated as to admit the forefinger readily; through the same wound the forceps can be introduced upon this as a guide."—(p. 508-11.)

Cheselden's *Operation.*

Cheselden's operation for the stone, his "lateral way," as he calls it, has much perplexed writers on this subject. Cheselden himself has distinctly given two modes in which he performed this operation; the first described in the Appendix to the *fourth* edition of his Anatomy of the Human Body, 1730; and the second in the Appendix to the *fifth* edition 1740; *seventh* edition, 1750; which was the last published in his lifetime, as he died in 1752; and, I presume, also in the *sixth*, though I have not had an opportunity of consulting this. In 1731, Dr. James Douglas published an Appendix to the History of the Lateral Operation for the Stone, containing Mr. Cheselden's present method of performing it. 4to. This differs remarkably from Cheselden's account in his *fourth* edition; but it is the same precisely, though more fully detailed, as in Cheselden's *fifth* and *seventh* editions; and, therefore, although Dr. Yelloly's (*a*) observation is perfectly correct, that "the least consideration will show that this (Douglas's) account of Cheselden's improved operation is perfectly irreconcilable with that which is given by Cheselden himself, in the Appendix to the *fourth* edition of his Anatomy, or by Mr. Morand, with his sanction and authority," yet the comparison of the fourth and fifth editions will prove that Douglas's statement is correct, and not "the absurd statement," nor "an operation which it is next to impossible to perform," as it has been designated by a highly distinguished Surgeon of the present time.

Cheselden's instruments were a staff, knife, and blunt gorget with a beak. The staff, including its handle and straight stem, measured six inches and a quarter in length, and to its extremity joined the grooved part five inches and a half more. "The *sulcus* or groove is remarkably deep and wide, the edges smooth and blunt—one end of it reaches a little way down on the handle, and the other, ending in an obtuse point, is without any check, as is seen in your common staffs. This part may again be divided into a curved portion and a straight *rostrum* or beak. The curvature next the handle not very great, and extends but a little way back from it; and from the extremity thereof, the long *rostrum* projects almost directly forwards." (*b*).

This statement of the curve and the length of the beak of the staff is important, as it will be seen in Cheselden's operation that there could not be any difficulty in introducing the gorget, as it would run at once into the bladder in a horizontal direction from the external wound, without depressing the handle of the staff, which depression is requisite as the operation is now performed, whether the common curved or straight staff be used. The other instruments need no notice.

Cheselden thus describes his operations, the commencement of which in the editions of 1730 (fourth) and 1740 (fifth) are alike, almost word for word:—"This operation I do in the following manner:—I tie the patient as for the greater apparatus, but lay him upon a blanket several doubles upon a horizontal table three feet high, or a little more, with his head only raised. I first make as long an incision as I well can, beginning near the place where the old operation ends, and cutting down between the *musculus accelerator urinæ* and *erector penis*, and by the side of the *intestinum rectum*; I then feel for the staff,"

Thus far the two editions are the same; but now comes the important difference:—

Fourth Edition, 1730.	Fifth Edition, 1740.
"and *cut upon it the length of the prostate gland strait on to the bladder*, holding down the gut all the while with one or two fingers of my left hand. The rest of this operation is the same as in the old way." (p. 344.)	"holding down the gut all the while with one or two fingers of my left hand, and cut upon it in that part of the *urethra which lies beyond the corpora cavernosa urethræ, and in the prostate gland, cutting from below upwards*, to avoid wounding the gut." (p. 330.)

(*a*) Med.-Chir. Trans., vol. xv. p. 347.

(*b*) Douglas's, above cited, p. 4.

Such are CHESELDEN'S own words, and the only difference between the operation of 1740 and Dr. JAMES DOUGLAS'S description is that it is more explicit; and, in his preface, he says:—"I am obliged to Mr. CHESELDEN for the chief materials of this paper; it was impossible to draw it up to good purpose without him; and since he has been so kind as to communicate to me, with the greatest readiness and without reserve all the particulars which I could not otherwise have come to the knowledge of, I am confident, that none will pretend to dispute but what I here describe is his operation, and his whole operation." The following is the important part of DOUGLAS'S description of the operation of CHESELDEN'S fifth edition:—After having detailed the first incision, he says that CHESELDEN "having cut the fat pretty deep, especially near the *intestinum rectum*, covered by the *sphincter* and *levator ani*, he puts the forefinger of his left hand into the wound, and keeps it there till the internal incision is quite finished; first to direct the point of his knife into the groove of his staff, which he now feels with the end of his finger, and likewise to hold down the *intestinum rectum*, by the side of which his knife is to pass, and so prevent its being wounded. This inward incision is made with more caution and more leisure than the former. His knife first enters the groove of the rostrated or straight part of his catheter, through the sides of the bladder, immediately above the *prostata*, and afterwards the point of it continuing to run in the same groove in a direction downwards and forwards, or towards himself, he divides that part of the *sphincter* of the bladder that lies upon that gland, and then he cuts the outside of one half of it obliquely, according to the direction and whole length of the *urethra* that runs within it, and finishes his internal incision by dividing the muscular portion of the *urethra* on the convex part of his staff. When he first began to practise this method, he cut the very same parts the contrary way; that is, his knife entered first the muscular part of the *urethra*, which he divided laterally from the pendulous part of its bulb to the apex, or first point of the prostate gland, and from thence directed his knife upward and backward all the way into the bladder; as we may read in the *Appendix* he lately published to the fourth edition of his Book of *Anatomy*. But some time after he observed, that in that manner of cutting, the bulb of the *urethra* lay too much in the way; the groove of the staff was not so easily found, and the *intestinum rectum* was in more danger of being wounded." (pp. 12, 13.)

In further proof of the correctness of DOUGLAS'S statement, SHARP (*a*), in speaking of RAU'S operation for the stone, and CHESELDEN'S first mode of proceeding in his lateral operation of 1730, says:—"After this unsuccessful trial, Mr. CHESELDEN made use of the following method, which is now the practice of most English operators. The patient being laid on a table, &c. This (the external) wound must be carried on deeper between the muscles, till the prostate can be felt, when searching for the staff, and fixing it properly if it has slipped, you must *turn* the edge of the knife upwards, and *cut the whole length of that gland from within outwards*, at the same time pushing down the *rectum* with a finger or two of the left hand, by which precautions the gut will always escape wounding." (pp. 99, 100.) And in contrast with this, speaking of "the old way, in which the *urethra* only is wounded about two inches on this side the prostate, and the instruments are forced through the rest of the passage, which is composed of the bulbous part of the *urethra*, the membranous part of the *urethra*, the neck of the bladder, and the prostate gland," he observes:—"It is pity, the operators do not in the old way always slide the knife, along the groove of the staff, till they have quite wounded through the length of the prostate." (pp. 104, 105.)

The remainder of the operation, as described in the *fifth* edition, are CHESELDEN'S own words:—"And then passing the gorget very carefully in the groove of the staff into the bladder, bear the point of the gorget hard against the staff, observing all the while that they do not separate, and let the gorget slip to the outside of the bladder: then I pass the forceps into the right side of the bladder, the wound being on the left side of the *perinæum*; and as they pass, carefully attend to their entering the bladder, which is known by their overcoming a straitness, which there will be in the place of the wound; then taking care to push them no further, that the bladder may not be hurt. I first feel for the stone with the end of them, which having felt, I open the forceps and slide one blade underneath it, and the other at the top; and if I apprehend the stone is not in the right place of the forceps, I shift it before I offer to extract, and then extract it very deliberately, that it may not slip suddenly out of the forceps, and that the parts of the wound may have time to stretch, taking great care not to gripe it so hard as to break it; and if I find the stone very large, I again cut upon it, as it is held in the forceps. Here I must take notice, it is very convenient to have the bladder empty of urine before the operation; for if there is any quantity to flow out of the bladder at the

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(*a*) Treatise on the Operations of Surgery. London, 1751. Sixth Edition.

passing in of the gorget, the bladder does not contract but collapse into folds, which makes it difficult to lay hold of the stone without hurting the bladder, but if the bladder is contracted, it is so easy to lay hold of it, that I have never been delayed one moment unless the stone was very small. (pp. 330, 31.)

Douglas also gives an account of the dissection of the parts concerned in this operation, which, he says, "I have had several good opportunities of examining in dead subjects, upon which Mr. Cheselden was so kind as, at my request, to perform his operation. I once likewise opened the body of a patient who had been cut by him for the stone, in which I found the parts divided in the very same manner in which they were cut in the dead bodies I had dissected." The parts he cuts are, *first*, the common integuments of the *perinæum*, and a little farther back, between the protuberance of the *os ischium* and extremity of the *os coccygis*. * * * *Second*, he divides sometimes the subcutaneous portion of the *sphincter ani*. * * * *Seventh*, he divides in a pretty oblique direction, a large portion of the *levator ani* that lies on the inside of the *ligamentum pubis transversum*, &c." These are some of the principal parts; but as Mr. Cheselden does not always make his outward wound precisely in the same place," they need not be further noticed. "The internal wound is through the bladder, prostate gland, and *urethra*. *First*, The *vesica urinaria*, covered with the *membrana cellularis* is cut in two places, viz., first, a small portion of it a little above the prostate gland; on the left side, where he enters the knife first into the groove of his staff, and then part of the bladder which lies round the orifice upon the upper part of that gland; *second*, the substance of one-half of the prostate gland is likewise divided laterally from without, inwards, in the direction of the *urethra* that lies within it, through the whole length of that part of the canal; *third*, the *iter urinæ*, or canal of the *urethra*, is divided in two places, and both laterally: first, the beginning of it, which runs through the substance of the prostate lengthways, at the same time the incision is made through it, and the *urethra* into the groove of the staff. The next is the membranous part of the *urethra*, with the circular muscle that surrounds it beginning at the *apex inferior* of the prostate, and ending a little beyond the hole in the *septum tendineum*, under the pendulous part of its bulb. * * * To this short enumeration of the parts, one observation may be added, which is, that if the operator turns the edge of his knife too far backwards, and then raises it to cut, he can scarcely be able to avoid wounding the *intestinum rectum* pretty high, some part of the *vesiculæ seminales* next the prostate, and the *verum montanum* within the *urethra* that runs through that gland, together with a large portion of the *levator ani anterior* and of the *ligamentum suspensorium vesicæ*, that closely embrace it." (p. 21–5.)

The celebrated Martineau, of Norwich, followed pretty nearly Cheselden's operation of 1730, using the knife and blunt-beaked gorget, the latter being employed, to use Crosse's words, "as a conductor, and also as a dilator of the bladder." (p. 75.) Martineau (*a*), describing his own operation, says he used "a staff in which the groove was *much wider* and deeper than usual, and therefore more easily felt; * * * he made his first incision long, deep, and nearly in *a line* with the *raphe*, which, he thought, facilitated the cure; he then felt for the groove, and introduced the point of the knife into it as low down as he could, and cut the membranous part of the *urethra*, continuing his knife through the prostate into the bladder; when, instead of enlarging the wound downwards, and thus endangering the *rectum*, *he turned the edge of the blade towards the ischium*, and made a lateral enlargement of the wound in withdrawing the knife; he thus avoided cutting over and over again, which often does mischief, but can give no advantage over the two incisions, which he generally depended on, unless in very large subjects, where a little further dissecting may be required. He then took the staff in his left hand, whilst he introduced the blunt gorget with his right, and by thus taking the management of the staff and gorget into his own hands, he better directed the latter, and discovered at once if it were slipping from the groove; but this will be prevented by depressing the gorget while it is pushing on towards the bladder. On this depends very often the ease and success of the operation. * * * After the gorget was in the bladder he introduced his finger, and endeavoured to feel the situation of the stone, which, if found, is a great advantage in the direction of the forceps to lay hold of it. He never used any other than straight forceps, and it will be found more easy to extract a stone whole, by rather large forceps, than with flat or small ones." (p. 409–11.)

Bromfield (*b*) describes very fully his mode of operating with the knife, and though not following Cheselden's method, distinctly shows that even he occasionally cut as

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(*a*) On Lithotomy; in Med.-Chir.Trans., vol. xi. 1820.

(*b*) Chirurgical Observations and Cases, vol. ii. London, 1772. 8vo.

CHESELDEN did, and as is stated by DOUGLAS. "I begin my incision of the external integuments," says he, "about half an inch below the commissure of the *ossa pubis*, on the left side of the *raphe*, and pursue it by a quick stroke, obliquely outwards and downwards between the *anus* and obtuse process of the *ischium*, ending somewhat lower than the basis of that process. As soon as the integuments are thus divided, I introduce the fore and middle fingers of my left hand: with the last I keep back the lip of the wound next the *raphe*, and with the *index* press down the *rectum*. I then make a second incision, almost in the same direction with the first, but rather nearer to the *raphe* and *anus*, and sufficiently deep to divide the *transversalis penis*, and as much of the *levator ani* and ligamentous membrane as will make the *prostate gland* perceptible by my finger; I then, with the *index* of my left hand, feel for the *sulcus* of the staff, which serves as a conductor to my knife for opening the membranous part of the *urethra*, and afterwards for dividing part of the *prostate;* the *rectum* is likewise by my fingers kept out of the way of the knife in the next part of the operation, which I effect in the following manner. Hitherto I hold the blade of my knife like a pen, between the forefinger and thumb, and resting on the middle finger of my right hand, with the back of the blade uppermost, but now I take it between the forefinger and thumb of my right hand, with the handle towards the palm of my hand on the inside, the back of the blade facing the inside of the *index* of the right hand: I then turn the back of this hand that holds the knife *downwards*, and convey the knife to the membranous part of the *urethra*, by gliding the under fingers of my right hand on the *index* of my left hand, which serves as a conductor of the knife to the gland; as soon as I perceive *that*, I feel for the groove of the staff with the *index* of my left hand, with which I convey the convex edge of the knife into the membranous part of the *urethra*, as much *laterally* as is possible, and as nigh to the *prostate*. When I am clearly in the *sulcus* of the staff, I turn the back of my knife as much downwards as I can, to avoid wounding the *rectum*, as I then push the blade of the knife along the groove of the staff into the body of the gland, sliding the knife on the convexity of its edge, till it has divided nearly half the length of that gland; and if I wish to cut a little more of it, I incline the handle of my knife a little downwards, and towards the left *ischium*. The *point of the knife* will then drop into the groove of the staff, and by drawing the knife in this situation towards me, I shall certainly make good the wound of the *prostate*, so as near two-thirds of it may be divided in the operation. This last stroke of my knife is what is generally called "cutting from within outwards." I then introduce the beak of the common gorgeret, &c." (p. 229-32.)

"The next step of the operation," says BRODIE, "is the continuance of the incision along the posterior part of the *urethra*, and the dilatation of the neck of the bladder. Some recommend this to be accomplished by means of the common scalpel, with which you have made the external incisions; the point being steadily introduced along the groove of the staff, with the edge turned outwards, so as to divide the left side of the prostate. This was CHESELDEN's mode of operating.—[Not his last mode of operating certainly, as I have shewn from his own words.—J. F. S.]—After having incised the prostate and neck of the bladder, CHESELDEN introduced the blunt gorget, so as to dilate the wound still further, answering at the same time the purpose of a conductor for the forceps; and, as far as I can learn, this method was followed generally by the English Surgeons up to the time of Sir CÆSAR HAWKINS," who "caused one side of the gorget to be ground to a sharp edge, and thus converted the blunt into a cutting gorget. * * * I cannot but think that there are some considerable objections to it (the cutting gorget.) The incision is made as it is being thrust into the bladder. In consequence of the thick wedge-like form of the instrument, the prostate, and especially a hard and enlarged prostate, offers to it considerable resistance. A certain quantity of force is necessary for its introduction; and if that force be not well applied, the beak may slip out of the groove of the staff into the space between the bladder and the *rectum*, an accident which is too surely followed by the death of the patient. * * * Although I have very frequently used the cutting gorget, I generally make the incision of the prostate with the knife," of which "the blade is broad enough to divide a considerable portion of the prostate as it enters the bladder, without its being necessary to increase the size of the incision by cutting laterally afterwards; and instead of a sharp point, it terminates in a beak, fitted to the groove of the staff. In ordinary cases, a knife of this kind with a single cutting edge is sufficient, but in cases of very large *calculi* there are good reasons for dividing both sides of the prostate. There is no objection to this being done that I can discover, and for such cases I have been for some time in the habit of using a double-edged knife with a beak projecting from its centre. Having made the opening into the membranous part of the *urethra;* you are to insert the beak of the beaked knife into the groove of the staff, you then take the handle of the staff into the left hand, depressing it at the same time. You depress your right hand also, so that the handle of the knife, which you hold in it, lies in the lower part of the external wound. You are now to push the knife along the groove of the staff into the bladder, with its cutting edge inclined outwards, and a little downwards towards the *ramus* of the *ischium*, if you use a single-edged knife; but holding it horizontally, if you use one with a double edge. Let this be done slowly and cautiously, taking care that you do not lose the feeling of the beak sliding over the smooth surface of the staff for a single instant. Generally, as the knife enters the bladder, a few drops of urine escape, but never any large quantity. This being accomplished, you are to withdraw the knife along the groove of the staff in the same line in which you introduced it. Never cut with it laterally, except you find it afterwards absolutely necessary to do so on account of the large size of the stone; for in cutting laterally, you will find it difficult to measure exactly the extent of your incision; and you may endanger your patient's life in consequence of your dividing the parts beyond the boundaries of the prostate. The next step of the operation is to introduce your finger, directed by the staff, into the bladder, so that you may feel the parts which are divided, and determine whether the incision is properly made. If you operate on a child, or on a young and thin person, you may then at once introduce the forceps into the bladder. But if you operate on a full-grown person, and especially on one having a deep *perinæum*, it will be prudent for you first to introduce the blunt gorget previously to using the forceps. * * * The gorget is intended to answer the purpose of a director for the forceps. But it answers another purpose also; it is a dilator of the wound—the knife divides only a portion of the prostate. The gorget splits the remainder as far as its breadth allows it to do so. Do not for an instant suppose that this is any rude or violent proceeding. It is far otherwise. The incision of the prostate having been begun by the knife, the extension of it by means of the blunt gorget is accomplished with the greatest ease. * * * You will ask why not make such a division of the parts by cutting laterally with the knife? Why prefer the dilatation of the wound by the blunt gorget? My answer is, that the separation of the parts with the latter instrument causes no hæmorrhage; and that it ceases as soon as it reaches the margin of the prostate; that is, as soon as it reaches the condensed cellular membrane, which forms what may be called its capsule." (p. 111–15.)]

2081. Langenbeck's knife (*a*) is specially distinguished by its point having a cover or guard, by means of which he passes it more readily and safely along the groove of the staff. It is used in the following manner:—When the membranous part of the *urethra* is laid bare, the nail of the left forefinger is placed in the groove of the staff, and directed by it, the point of the lithotome perforates, the parts still covering the staff; the right hand holding the stem of the lithotome, inclines it towards the right thigh, so that its point forms a right angle with the beak of the staff, the handle of which is held inclined towards the right groin, and with its outer edge a little downwards. The point of the knife is now carried a little forwards in the groove of the staff, for the purpose of enlarging the opening, and moved up and down in the groove, in order to open it satisfactorily. The hand of the assistant, and with it the handle of the staff, is then grasped with the left hand and raised so as to bring its concavity against the pubic arch: whilst this is doing the point cover is pushed forwards, the handle of the lithotome being firmly pressed against the palm of the hand by the ring, middle, and little fingers, the point of the forefinger carried from the back to the side, and the thumb on the back of the instrument, so that the latter lies fixed behind the button of the point cover, and, as it is straightened, thrusts the cover forwards; the knife is then moved up and down to ascertain that it is actually in the groove of the staff. The lithotome then, with its edge towards the extremity of the cut in the skin, is thrust along the staff to its blind extremity, in doing which the point of

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(*a*) Ueber eine einfache und sichere Methode des Steinschnittes. Würzb., 1802. His alteration of the Lithotome is found in the Neue Bibliothek für die Chirurgie und Ophthalmologie, vol. i. p. 429, f. 1.

the lithotome is first a little sunk and the handle raised, till it has passed beyond the curved part of the staff, when the handle is sunk and the point a little raised. The knife is withdrawn in the same direction.

[Thomas Blizard, who was a very able operator, after opening the groove of the staff in the usual way, divided the prostate gland, laterally, by means of a narrow-bladed knife, about four inches long, and having a beak inclined at an angle towards the right side of the blade. (I am informed by his nephew Stanley, that he never lost a patient from bleeding, after this operation.) Astley Cooper, also, for a time used a long-beaked knife, but with the beak projected directly forward; the greater number of operations, however, which I saw him perform were done with the single-cutting gorget. He was, however, as Tyrrell observes, "fond of variety," and I have seen him operate with both single and double cutting and blunt gorgets, as well as with the knife.

Tyrrell always used the straight-beaked knife for dividing the prostate gland. He was a very able and successful lithotomist, and thus describes his operation (*a*) :—"The staff is first introduced, and should well fill the *urethra;* the larger it is the better, as you have the advantage of a deeper groove. The staff is then firmly held by an assistant, and the bulb of the *penis* is made to project a very little towards the left side. I now take the double-edged scalpel, make an incision through the integuments and *fascia* of the *perinæum* on the left side of the *raphe*, commencing at the point just beneath the lower edge of the *symphysis*, at the place where the *urethra* begins to curve under the arch of the *pubes*, and continue it downwards and outwards to opposite the middle of the *anus*, between it and the tuberosity of the *ischium*. If you begin above the place just mentioned, it cannot be of any service in extracting the stone. I next make an incision into the groove of the staff, as near as possible to its median line, because I think the danger of hæmorrhage from the transverse artery of the *perinæum* or any other artery is less in proportion to the distance you are from its origin. As soon as I have laid open the *urethra* and carried the knife into the groove, I introduce the nail of the forefinger of my left hand and satisfy myself that the knife is properly within the groove, although you may feel pretty confident of it by the sensation produced in rubbing the knife in the staff. Then incline the edge of the knife a little outwards, and carry it on nearly to the prostate gland, then I carry it down deeply into the *perinæum*, in the direction of the first incision, to divide the deep muscles there as I withdraw the knife. I then lay aside the scalpel, and take Astley Cooper's long straight knife in my right hand, take hold of the staff firmly with my left, and then introduce the beak of the knife fairly within the groove, keep it well against the staff, and carry it onwards, following the curve of the staff, into the bladder. The knife having entered the bladder, I give the staff to an assistant to hold steadily in the same position, and introduce my finger on the surface of the *rectum*, under the point of the knife, which I can then feel in the bladder, and divide the prostate, as I withdraw the knife, in the direction of the former incision, letting its probe point rest on my finger, which is at this time protecting the *rectum* from injury. If I operate on a child, where the *perinæum* is shallow, I introduce my finger into the bladder and feel the stone, and then withdraw the staff and introduce the forceps on the finger. But if the *perinæum* is deep, I introduce the forceps with the blades a little open, and glide one blade along the groove of the staff, upon which it very readily finds its way into the bladder, and rests upon the stone, which I then grasp, by deliberately opening the blades of the forceps, and cautiously withdraw it." (pp. 637, 38.) To this account of Tyrrell's mode of operating I may add, that in introducing and withdrawing the beaked knife, he did not hold the blade vertical, but with its sides inclining a little upwards and downwards, so that the edge was turned somewhat outwards, and the knife seemed to leave the wound after dividing the prostate almost flat.—J. F. S.]

2082. The cut having been made in one of these ways, the finger is passed through the wound into the bladder, the staff removed, and, if the cut be sufficiently large, the forceps are introduced upon the finger, for the purpose of drawing forth the stone without much bruising and tearing of the edges of the wound; but if the cut be too small, it must be enlarged, *carefully* and *slowly*, with the finger, the forceps, or some special dilator, or with a button-ended bistoury, according to the direction of the outer wound.

2083. This mode of operating is the most simple of all; the operator

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(*a*) Clinical Lectures on Stone in the Bladder; in Lancet, 1823–24, vol. ii.

does not depend on the mechanism of his instrument, but can modify its direction and efficiency at his pleasure. It is dangerous in unpractised hands, which, however, is also the case with every operation. The entrance of the knife into the groove of the staff may be difficult; it may slip from it, and the *rectum* and bladder may be wounded. LANGENBECK's lithotome allows an easy and safe introduction into the groove of the staff.

2084. The *cut into the neck of the bladder and the prostate gland with a particular instrument, from without inwards.* To this belongs the use of the *cutting gorget*, and of LE CAT's *bistouri caché.*

2085. In *using the cutting gorget*, the nail of the left forefinger, after the membranous part is laid bare by the external cut, is introduced into the groove of the staff, and the membranous part of the *urethra* laid open to some extent by the bistoury carried upon it. The beak of the gorget is now entered into the groove of the staff thus opened, upon the finger-nail still remaining there, the handle of the staff grasped with the left hand, and, after moving the gorget several times up and down, to ascertain that its beak is certainly in the groove, the gorget is pushed forward to the blunt end of the staff, the staff removed, and the forceps introduced.

The cutting gorget, invented by HAWKINS (*a*), in 1753, has undergone various modifications, of which those by DESAULT (*b*), CLINE (*c*), ASTLEY COOPER (*d*), SCARPA (*e*), and GRAEFE (*f*) are considered the best.

[Although SHARP (*g*) states, that CHESELDEN's lateral operation "is now (1751) the practice of most English operators," (p. 99,) yet it appears not to have been pursued for any great length of time, and, perhaps, not so largely as SHARP would seem to infer; as if it were practised by others with anything like similar success to that of CHESELDEN himself, it would be scarcely probable that Serjeant HAWKINS should have set about improving the blunt gorget, by giving one of its sides a cutting edge, which he did between 1751 and 1754, for, "after having mentioned the objections to the continued incision of the *urethra*, and prostate gland" in the old way, or with the apparatus major, SHARP (*h*) says:—"I shall observe, that Mr. Serjeant HAWKINS seems to have fallen on an ingenious contrivance, not only for removing them, but also giving the last hand towards perfecting the lateral operation.—[Though he should more correctly have said, altering the old mode of dividing the prostate with the blunt gorget, by dividing it with a cutting gorget, which was very different from CHESELDEN's operation.—J. F. S.]—This he effects by making his gorget to cut on the right side, so that when it is introduced upon the staff, and pushed on into the bladder, it necessarily makes an incision on the left side of the *urethra* and prostate gland." (pp. 212, 13.) As HAWKINS's gorget still retained the form of the blunt gorget, except as to its cutting edge, it could not divide the prostate laterally, but upwards and outwards; or, as SCARPA observes, "not laterally, but rather at its upper part, towards the summit of the *ramus* of the *ischium*, and the arch of the *pubes*; an opening of all others, in the *perinæum*, the most confined, and presenting the greatest impediment to the passage of the stone from the bladder" (p. 13); so that the prostate was really not divided as in CHESELDEN's operation. HAWKINS's gorget, which was pretty much like HILDANUS's conductor or blunt gorget, with the beak in the middle, had a cutting edge about two-thirds of its length; but ELSE (*i*) observed, that "it should not cut the whole length of the instrument, as it will then do much mischief by wounding the internal pudendal artery, which is pretty large, and cannot be easily secured, therefore the gorget should not cut more than half an inch in

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(*a*) A. F. PALLAS, De variis Calculum secandi methodis. Lugd. Batav., 1754.—A. LOUIS et HAGUER, Dissert. de Methode HAWKINSIANI in calculosorum sectione præstasitia. Paris, 1770.

(*b*) Abhandlung über der Steinschnitt nach der verbesserten HAWKINS'schen Methode; in Chirurg. Nachlass, vol. ii. part iv. p. 180.—HAUSMANN, Beurtheilung der HAWKINS'schen Methode den Blasenstein zu operiren. Braunschweig, 1782.—LODER, Bemerkungen über HAWKINS' Methode; in this Journal, vol. ii. p. 348.

(*c*) EHRLICH's Chirurg. Beobacht., vol. i. p. 227, pl. iii. f. 2, 3.

(*d*) SAVIGNY, Engravings, &c., pl. vi. fig. 4.

(*e*) Mém. de l'Institut, vol. ii. p. 1.—Erinnerungen über HAWKINS schneiddendes Gorgeret zur Ausziehung des Blasensteines; in Salzb. Med.-Chirurg. Zeitung, vol. i. p. 31.—OLLIVIER, above cited, p. 1. pl. 1.

(*f*) Bernsteines Prakt. Handbuch für Wundärzte, vol. iii. p. 98. Fifth Edition. Leipzig.

(*g*) Treatise on the Operations of Surgery. London, 1751. Fourth Edition.

(*h*) Critical Enquiry into the present state of Surgery. London, 1754. Third Edition.

(*i*) MS. Lectures on Surgery.

length." Whether this restriction of the length of the cutting edge originated with him, or with BENJAMIN BELL I cannot positively state, as the copy of ELSE's Lectures I have is without date: but I should be inclined to think it did, or it is probable he would have mentioned the in other respects variation of shape which BELL's gorget has. In this latter instrument, the shaft is much narrowed, and deep to within an inch of the beak, at which part it suddenly sweeps out on the right side like a lip, and thence cuts with a sharp rounded edge to the beak.

A very slight inspection of either of these gorgets will show, that they cannot divide the side or thicker part of the prostate gland, but that they must cut through its upper part, making, as SCARPA observes, " an opening, of all others in the *perinæum* the most confined, and presenting the greatest impediment to the passage of the stone from the bladder." (p. 13.) To remedy this objection, the elder CLINE made a most important change in the form of the gorget. Instead of the beak being, as previously, in, or nearly in the middle of the end of the instrument, which was rounded, he placed the beak on the left side, lengthening that side a third beyond the right side, by a flat horizontal plate beyond the concavity of the gorget. In this way a straight diagonal edge was formed, from the short right to the long left side of the instrument; this diagonal was made a cutting edge, and at its extremity projected the beak about a quarter of an inch, flattened on the sides, and reaching a little above and a little below the cutting edge. The extent of the wound made by this instrument depended upon the width of the shaft of the gorget, which was equally wide and moderately deep, from the hind part of the cutting edge up to the handle. The width of the shaft varied from half an inch to an inch in different sized gorgets; for children, the former was usually employed; in adults, generally one of three-quarters wide, and when the prostate was large, that of an inch. Such width was found by experience sufficiently ample for the division of the prostate, but not so as to cut into the cellular tissue surrounding that gland. With this instrument I witnessed my highly valued master, the younger CLINE, operate twenty-six times with the loss of three cases, one of which an elderly man, sunk within a few hours without any assignable or discoverable cause beyond the shock of the operation, and another, whose stone was triple phosphate, died a few days after, and was found to have the bladder, now in the Museum at St. Thomas's, much thickened, and its whole interior beset with fungosities. With the same instrument my friend GREEN cut about forty (*a*) cases successively, without losing a case. Sufficient proof, it must be admitted, that the cutting gorget is not the dangerous instrument, either as to its immediate or deferred results, which it has been so much the fashion to describe it.

SCARPA objected to HAWKINS's gorget, on the grounds already mentioned; and thought that the alterations of it by BELL, DESAULT and CLINE, rendered it " an instrument, of all others, least adapted to the performance of the lateral operation" (p. 14); and therefore made an alteration of his own, which diminishing the general width of the instrument, still kept the two-thirds of the edge nearest the point cutting, as in HAWKINS's instrument, but widening the middle third to the extent of three lines, in a somewhat elliptical form. His instrument has not, however, found many admirers in this country.

ASTLEY COOPER at first used a gorget with a central beak, " and cutting upon both edges, but he thought it occasioned too much bleeding, and divided more than was absolutely necessary for the removal of the stone." He therefore gave it up, and operated sometimes with CLINE's gorget, and sometimes with his own knife; but I think I saw him more frequently use the former in his hospital practice.—J. F. S.

The directions given by CHELIUS for the use of the cutting gorget are not satisfactory, for more is requisite than to introduce its beak into the staff, and push it forward. Such, however, is the too common method of using the instrument, and hence arises the difficulty and danger with which, in the hands of inattentive persons, it is beset.

It will be convenient here first to mention the directions given by ASTLEY COOPER, for opening the membranous part of the *urethra*, which are those commonly adopted in the operation with the cutting gorget. "The *scrotum* being elevated, the incision is begun opposite the under part of the arch of the *pubes*, and is continued on the left side of the *raphe*, along the *perinæum*, as far as midway between the tuberosity of the *ischium* and the *anus*. The first incision should divide the skin, &c., and expose the *accelerator urinæ*; the second should be carried between the left *crus penis* and the bulb, the latter being pressed towards the right side by the forefinger of the Surgeon's left hand. A part of the *accelerator urinæ* is divided, and the *transversus perinæi* should be freely cut, as it forms a great impediment to the extraction of the stone, if undivided. The next incision should be made into the groove of the staff, by cutting into the membranous portion of the *urethra*; for this purpose the knife must be directed upwards,

(*a*) Lancet, 1827, 28, vol. i. p. 61.

(that is, its point raised towards the handle of the staff,—J. F. S.,) and not horizontally, otherwise the *rectum* is endangered. The opening made to expose the groove of the staff should be an inch in length." (pp. 249, 50.)

The membranous part of the *urethra* having been opened by the third cut, and well opened, by moving the point of the knife up and down so as to have it perfectly bare, the left forefinger-nail should be pressed into it, immediately on the knife being removed, and there retained. Using the nail as a guide, the beak of the gorget (Cline's, with the single-cutting edge) is entered upon it into the groove, and the finger withdrawn. The Surgeon then moves the beak of the gorget twice or thrice up and down in the groove of the staff, to assure himself that the beak is free, and not entangled with any cellular tissue, by which, in his further proceeding, it might be jerked out of the groove. The body of the gorget should be held horizontal, and its cutting edge inclined a little downwards, and outwards. The operator now, with his left hand, takes the handle of the staff from the assistant, and brings it down till it form an obtuse angle with the *perinæum*—in short, till the staff, if it were straight throughout and thrust onwards, would pierce through the *umbilicus*, its direction corresponding to the axis of the *pelvis*, which Green considers a most important part of the operation, as it ensures the proper course of the gorget. At the same time that the handle of the staff is sunk, the gorget is pushed very gently forward, and without any violent pressure, cutting its way through, and dividing the prostate laterally, it enters the bladder. The great point to be remembered is, the depression of the handle of the staff, so that that part of its groove, on which the beak of the gorget rests, face downwards towards the *sacrum*, and consequently when the gorget is slightly pressed forward it meets no obstruction, and runs gently on. If, however, the staff-handle be not depressed, the beak of the gorget drives directly against the staff, and cannot move forward, the staff-groove standing up like a wall against it, and the opposition is the greater the more force is used, till the operator unwittingly alters the position both of staff and gorget, depressing the handle of the former, and raising that of the latter, so that its point dips, finds less resistance in the now oblique position of the groove of the staff, and then is pushed on into the bladder, if the operator have good luck, or slips out of it, and passes between the bladder and *rectum*, or between the bladder and *pubes*, which may be expected, if he use much force and have little discretion. I have seen also, in more than one or two instances, when the staff-handle has been little or insufficiently depressed, so much force used, without getting the gorget to move on, that the staff was bent, above its curve, and could only be withdrawn with difficulty.—J. F. S.]

2086. All the cutting gorgets have this objection, namely, that in pushing forward their beak in the groove of the staff, they often merely push forward the neck of the bladder, and do not cut through it; they require much greater force than any other instrument; the inner wound has not the same parallel direction as the outer; on account of the lateral direction of the inner cut, the pudic artery is most liable to injury; and if to avoid this, a more descending direction be given to the instrument, there is no protection against wounding the *rectum*. The introduction of the forceps upon the gorget is but a trifling advantage (*a*).

[These objections to the cutting gorget are entirely groundless. No more force is requisite for introducing the gorget than for dividing the neck of the bladder and the prostate with the knife. The instrument neither requires force, nor is force employed, if the operator know how to use it; and, therefore, whatever mischief is done is the fault of the Surgeon, and not of the instrument. In passing into the bladder, the cutting gorget must cut through its neck, and also the prostate gland. It cannot push it before it, so long as it remains in the groove of the staff; but if it slip from it, as is occasionally, though not often the case, even in the hand of an unskilful operator, without violence, the beak of the instrument more readily slips between the bladder and *rectum* than drives on the neck of the bladder. But this cannot happen, except from carelessness, without force being employed to drive the gorget on, which is never required so long as the instrument takes its proper course; and if the gorget will not enter without violence, the Surgeon may feel

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(*a*) Textor, C., Ueber die Ursache des Nichtauffindens der Blasensteine, nach gemachter Operation der Lithotomie, p. 22. Würzburg, 1816.—Zang, Operationen, vol. iii. pt. ii. p. 177.

pretty well assured, in nineteen cases out of twenty, that he is misusing the instrument, and that he will get into mischief. The difficulty in introducing the gorget, and the force occasionally seen expended on it, depends, as has been mentioned, on the operator forgetting to sink the handle of the staff, so as to place its groove in the line which the gorget has to travel; and, consequently, he rams the beak of the gorget against the staff, which he continues to hold nearly upright, so that till he accidentally alter the position of the staff, or, by dint of force, the beak of the gorget slips down the curve of the staff, it is impossible for the gorget to pass into the bladder, though easy enough for it to slip from the staff, and get between the bladder and *rectum*.

The want of parallelism of the internal with the external wound is really of no consequence, even admitting that it be greater than in division of the neck of the bladder, and of the prostate, with the knife, of which I cannot allow it is.

The division, or rather wounding, of the pudic artery, by the introduction of the gorget, might be matter of more serious objection against the employment of that instrument, were it as frequent as CHELIUS and others imagine; but from my own observations of the practice of others, as well as my own, I believe it very much less frequent than generally supposed; and the free bleeding which occurs sometimes in the operation, either with the gorget or knife, for I have seen it as great with the use of one as of the other instrument, depends, I believe, usually on division or wounding the artery of the bulb, just after it comes off from the pudic artery, and not from injuring the pudic artery itself. The use of the gorget, as a ready channel for the introduction of the forceps, is, as CHELIUS observes, of but little importance.—J. F. S.]

2087. LE CAT's method, which, in recent times, has been especially modified and employed by PAJOLA, is characterized by the prostate gland being *in part only* divided, and the enlargement of the wound being effected by a peculiar dilator.

According to PAJOLA, the patient should be laid with his trunk a little obliquely; the staff, when introduced, is to be held by an assistant, with its handle so inclined towards the right groin, that its curved part should rest between the left side of the *raphe* and the ascending branch of the left haunch-bone. The external cut is made, as regards its size and direction, in correspondence to the prescribed directions, (*par.* 2078,) with the *urethrotome*, which is held like a writing-pen, with its groove facing towards the patient's left side. When the membranous part of the *urethra* is laid bare, the nail of the left forefinger is passed into the groove of the staff, the bulb pressed aside, the urethrotome thrust into the membranous part close behind the bulb, and carried carefully along the groove of the staff, so as to divide the membranous part to the extent of from four to five lines. The operator now keeps the point of the urethrotome against the staff, brings its handle horizontal, and takes hold of it with his left hand in such way that the thumb is on the upper edge and the fore, middle, and ring fingers are upon the under edge of the handle. The operator now grasps the *cystotome* with his right hand, and placing his middle finger in its ring, his third and fourth fingers on the under, his thumb on the upper surface of its handle, and the forefinger on the sheath of its blade, enters its beak into the groove of the urethrotome, and upon it into that of the staff, and then takes away the urethrotome. When the operator ascertains by the sensation which the contact and rubbing together of the two metallic bodies affords, that the beak of the cystotome is actually in the groove of the staff, otherwise the cystotome must be withdrawn, the membranous part at once opened, and the instrument introduced as before, he grasps, with his own left hand, the handle of the staff, together with his assistant's hand, carries it in a direction corresponding to the white line, raises it beneath the arch of the *pubes*, so that it forms a right angle with the trunk, and pushes the cystotome, the handle of which he sinks a little, along the groove of the staff, up to its blunt extremity. After the cystotome is withdrawn, the operator carries the point of his left forefinger upon the staff and into the opening in the bladder; the staff is then withdrawn, and a blunt gorget, previously oiled, with its concavity upwards, is introduced upon the sensible surface of the left forefinger, which serves as a guide. The dilator, with its front blades closed, is now introduced upon the gorget, and after the withdrawal of the gorget, the wound in the prostate gland is *gradually* enlarged, by bringing together the hind branches of the dilator to such extent as the size of the stone seems to require.

For the further description of this operation, the following writers are referred to:—

Le Cat, above cited.

Kast, (præside C. Siebold,) Historia Lithotomiæ in eodem homine bis factæ. Wirceburg, 1778.

Hartenkeil, above cited.

Loder, Programma Lithotomiæ Le Catianæ emendatæ Descriptio. Jenæ, 1785.

Koelpin, A., De Calculi Vesicæ sectione laterali inprimis Le Catiana; in Opuscula Chirurgica, vol. i. Hafniæ, 1799.

Rudtorffer, F. X., Abhandlung über die Operation des Blasensteines, nach Pajola's Methode. Leipzig, 1808; with five plates.

2088. This operation has partly the same objection as the cutting gorget, that the parts are easily pushed before it, and not always cut through to the required extent; and that the enlargement of the insufficient cut with the dilator not unfrequently causes great bruising, and its consequent symptoms, especially a permanent weakness of the neck of the bladder and the like. Experiments upon the dead body have satisfied me that the use of the dilator does not effect a simple enlargement, but if the extension be great, an *increase of the wound by tearing*. In other respects this operation is more complicated than all the other modes; it is, however, employed with considerable success.

2089. The *Cut into the Neck of the Bladder and the prostate, with a particular instrument, from within outwards*. To this belongs Frère Côme's method with the concealed lithotome (*lithotome caché*.)

When the outer cut has been made and the membranous part is opened, the concealed lithotome is entered into the groove of the staff upon the nail of the left forefinger, which has been previously introduced into it. The operator with his left hand grasps the handle of the staff, raises it under the arch of the *pubes*, satisfies himself that the lithotome is in the groove, by moving it up and down, and then pushes it on in the direction of the staff, to its extremity. The staff is now withdrawn, after having been passed a little farther into the bladder, to disengage the point of the lithotome, with which it must be attempted to ascertain the size of the stone, and then the instrument is gauged at a higher or lower number, in accordance with the size of the required cut. The lithotome is now held with the left thumb and forefinger on its lock, is raised under the pubic arch, and whilst the handle is grasped with the right hand, and the lever pressed down with the third and fourth fingers upon the handle, the blade is drawn out horizontally, and inclined towards the lower angle of the wound.

he following writers may be referred to on this operation :—

Journal des Sçavans, 1748, Juin.

Frère Côme, Recueil des pièces impartiales sur l'Opération de la Taille faite par le Lithotome caché. Paris, 1735.

———, Additions à la suite de Recueil de toutes les pièces qui ont été publiées au sujet du Lithotome caché. Paris.

De Preval, Ergo scalpello vagina recondito cystotome lateralis perfectior. Paris, 1754.

Cambron, Lettre sur la Lithotome, pour prouver la supériorité du Lithotome caché. Paris, 1760.

Nahuys, Parallèle de la Taille latérale de M. Le Cat avec celle du Lithotome caché. Amsterd., 1766.

Chastanet, Lettres sur la Lithotomie, pour prouver la supériorité du Lithotome caché pour l'Opération de la Taille sur tous les autres instrumens. Paris, 1768.

Sabatier, Remarques sur l'Opération de la Taille avec le Lithotome caché, et sur le Jugement que l'Académie de Chirurgie a porté de cette opération, dans le troisième Volume de ses Mémoires; in Mém. de l'Institut National de France, vol. ii. p. 341.

2090. The disadvantages objected to the concealed lithotome are, wounding the inner wall of the bladder when its blade is gauged at the higher numbers ; the great danger of wounding the *rectum* or the pudic artery if its blade be not immediately directed towards the ischial tuberosity ; and the difficulty of finding the aperture in the bladder, when the staff has been withdrawn before the cut is made (*a*). It has been attempted to do away with many of these objections, by shortening and blunting the blade, so that after the lithotome has been introduced into the bladder the staff should not be withdrawn, but that, without its point leaving the staff, the lithotome might be drawn out of the bladder, or that the instrument should be furnished with a small gorget, or with a sheath to its blade (*b*). It must be remembered, however, that with very unruly patients this instrument can be used more safely than any other, and is always to be considered as one of the most preferable.

Boyer (*c*), who prefers Frère Côme's lithotome to any other, uses it in the following way :—In adults and elderly persons he never gauges the instrument higher than No. 11, however large the stone may be, and in general only up to No. 9. He prefers enlarging this cut if it be too small. In drawing out the instrument, instead of pressing the shaft up against the pubic arch, he presses its concave side on the branch of the right pubic bone, so that the blade is inclined *almost directly outwards.* When he is satisfied by the length of that part of the instrument which has been drawn out, and the cessation of resistance that the prostate and the neck of the bladder are cut through, he allows the blade to return into its sheath, and withdraws the instrument closed, by which wounding the *rectum* and the pudic artery are avoided. The transverse direction of the inner wound is made correspondent with the outer by the introduction of the finger, and does not prevent the entrance of the forceps.

2091. In the same way, as Chaussier and Beclard (*par.* 2062) had recommended *cutting into the prostate and neck of the bladder on both sides*, as being the more correct interpretation of Celsus's text, did Dupuytren perform successfully and fully lay down this mode of operating, the *bilateral section*, as it is called, in the year 1824.

The patient is placed and fastened in the usual way, and the staff held by an assistant vertically and corresponding to the *raphe.* The operator with a straight-pointed bistoury makes, at a distance of six or seven lines from the *rectum*, a transverse cut, the slight curve of which has its

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(*a*) Mémoires de l'Académie de Chirurgie, vol. iii. p. 628.—Scarpa, Dupuytren, Textor, above cited.

(*b*) Beck, R., Ueber den Seitenschnitt mit dem Stromeyer'schen doppeltgedeckten Steinmesser Carls. u. Freib., 1844.

(*c*) Traité des Maladies Chirurgicales, vol. ix p. 391.

concavity downwards, and its middle over the *raphe.* The membranous part being laid bare, is opened, and the point of the bistoury introduced upon the nail of the left forefinger into the groove of the staff, and carried some way along it. A peculiar lithotome is then entered into this opening, and pushed along the groove of the staff into the bladder. The neck of the bladder is divided, in withdrawing this instrument, by knives which project on both sides, in the direction of the external wound. A gorget is then introduced, and upon it the forceps.

DUPUYTREN's lithotome is similar to that proposed by FLEURANT for operating on women for the stone; the two blades may be separated to a distance of eighteen lines. CHARRIÈRE's improvement consists in the blades projecting obliquely downwards. LA SERRE's alteration which is inefficient, consists in their acting first in the horizontal, and then in an oblique direction. ASTLEY COOPER cut through the neck of the bladder on both sides with a double-edged gorget.

Upon this subject the following works may be consulted :—

OLLIVIER, above cited, p. 237.

Archives Générales de Médecine, vol. v. p. 159. 1824.

Répertoire Générale d'Anatomie et de Physiologie Pathologiques, vol. i. p. 240.

Leçons Orales de Clinique Chirurgicale, vol. ii. p. 381.

DUPUYTREN, Sur une Manière Nouvelle de pratiquer l'Opération de la Pierre; terminé et publ. par SANSON et BÉGIN. Paris, 1836.

2092. BECLARD altered his mode of performing the *sectio bilateralis* from that which he first advised, and proceeded in the following manner: Leaving the staff, which had been first introduced, alone, so as not to disturb the position of the parts, he made a cut through the coverings, as in the lateral operation, with a knife similar to that of DUBOIS; then opened the membranous part upon the left side and behind the bulb, and passed the knife nearly transversely, with its edge directed to the left, into the bladder, and enlarged the opening in drawing back the knife. At this point of the operation, he raised his hand, and gave the blade of the bistoury a direction parallel to the axis of the prostate, in order to avoid injuring the seminal vesicles and the base of the bladder with the point. If the stone could not be drawn out through this opening, he enlarged it with the button-ended bistoury; and if this did not answer, he made a second cut *transversely* to the right side into the neck of the bladder and body of the prostate.

SENN (*a*) proceeded in the same way, except that he directed the first cut into the neck of the bladder *more obliquely downwards*, as in the common lateral operation. The external tegument need not be cut into in the second transverse cut, as it is capable of great extension.

LE DRAN (*b*) had already proceeded in a similar way; after cutting into the neck of the bladder, he passed his forefinger into the neck and upon it a small bistoury, and then made upon the right side a cut similar to that on the left.

VIDAL DE CASSIS (*c*) has proposed cutting into the neck of the bladder in four directions. And COLOMBAT has recommended an instrument, (*lithotome quadruple,*) in which two blades project upwards and outwards, and two downwards and outwards (*d*).

2093. The advantage of the bilateral section is, that it affords a cut of very large extent for the removal of a large stone; without danger of wounding the pudic artery; and the *rectum* may be avoided, notwithstanding the large size of the cut. In regard to DUPUYTREN's semicircular external cut, it may be remarked, that the transverse artery indeed

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(*a*) Dissert. Recherches sur les différentes Méthodes de Taille soupubienne. Paris, 1825.

(*b*) Suite des différentes manières de faire l'Extraction de la Pierre. Paris, 1756.

(*c*) Taille quadrilatérale, Thèse. Paris, 1828.

(*d*) OLLIVIER, above cited, p. 238.—Archives générales de Médecine, vol. viii. p. 139, 309, 310.

may be avoided; but that this cut is difficult for a less experienced operator, and a slight variation from the prescribed mode causes that vessel to be wounded. The bulb is also easily wounded, especially in old persons, in whom it is large, and juts back so much that it is not easily pressed down; and if the knife be sunk deeper to avoid it, there is danger of wounding the *rectum*. Both, however, may, according to **Senn**, be more certainly avoided, if the membranous part be divided, not lengthways, but transversely. **Beclard** thought it a particular advantage of this operation, that the edges of the wound lie close together, and that the cure follows more quickly (*a*). **Souberbielle** (*b*) considers that the double cut should be so large, that the extraction of the stone should entirely separate the middle from the other parts of the prostate.

2094. One of the most important circumstances, which has the greatest influence in deciding on the several modes of performing the lateral operation for the stone, is the variety of opinions as to the *room which the cut into the prostate and neck of the bladder can give, and which can be given with safety.* Many make the cut so large that the stone can be withdrawn without stretching and bruising the parts; they divide, when the size of the stone needs it, the whole prostate, and continue the cut even into the body of the bladder; considering a clean cut less disadvantageous than the tearing and bruising by simple dilatation. Others fear large cuts, as if the whole prostate be divided into the bladder, infiltration of urine, abscesses and gangrenous destruction of the cellular tissue between the bladder and *rectum*, weakness of the neck of the bladder, slow cure, and fistula, may ensue.

It is most advisable to cut sufficiently deep into the prostate and neck of the bladder, without continuing the cut into the body of the bladder, and to enlarge the opening in a gentle and gradual manner with the finger or the forceps. This enlargement may be carried to such extent that very large stones may be withdrawn, and by this mode of enlarging the wound the objections do not apply which for the most part result from the great apparatus, as if the prostate and neck of the bladder be properly cut into, the enlargement is made in a very different way. To **Dubois'** knife, with which I cut into the prostate and neck of the bladder, as I introduce it, but especially in drawing it out, I give the preference above all the other modes of practice. If the cut do not correspond with the size of the stone, I enlarge it with the button-ended straight bistoury, which cuts only to the extent of an inch.

[**Scarpa**, as already noticed, (p. 583,) has well pointed out the extent to which the prostate should be divided, and the capability of doing this, to a certain and definite extent, is the great advantage of the cutting gorget, which can only divide the prostate equal to its own breadth. If the prostate be divided with the knife, the extent of the division must depend entirely upon the operator, and is liable to vary considerably.—J. F. S.]

Upon the matter just considered the following works may be also consulted:—

Klein, Chirurgische Bemerkungen, p. 1. Stuttgart, 1801.

Praktische Ansichten der bedeutendsten chirurg. Operationen; part ii. Stuttgart, 1816.

Martineau, in Med.-Chir. Trans., vol. xi. p. 402. 1820.

Cooper, Samuel, Dictionary of Practical Surgery,—Art. *Lithotomy*, p. 889.

Dupuytren, above cited, p. 17.

(*a*) **Ollivier**, above cited, p. 244.—**Royer-Collard**; in Répertoire générale d'Anatomie et de Physiologie, vol. i. p. 507.

(*b*) Journal de Médecine, vol. cvii. p. 416. 1829.

Scarpa; in Ollivier, p. 1–40.
Chelius, Ueber den Steinschnitt; in Heidelb. klinisch. Ann., vol. vi. part. iv.

2095. The *extraction of the Stone* is in general accompanied with great difficulty, and requires the more careful and skilful management, as upon the proper performance of this part of the operation depends principally its successful or unfavourable result. The left forefinger, and in very stout persons, a blunt gorget upon it, is passed into the opening of the neck of the bladder, and upon it the forceps (*a*), previously oiled, are carried in a rather oblique direction from below upwards into the bladder. The forceps are then gently turned about in various directions to find the stone, and when it is found, the handle-rings of the forceps are to be taken hold of with both hands, widely opened, and the forceps pushed farther into the bladder, or turned half round with a sweep, so as to bring the stone between their blades and to grasp it. When the separation of the handles shows that the stone is seized, the thumb and middle finger of the right hand are put into the rings of the forceps, or the instrument is grasped with the whole hand, but in either case the forefinger is kept between its handles, partly to prevent breaking the stone, and partly to prevent the walls of the bladder catching in drawing out the forceps, which are to be turned round on their axis, so as to ascertain that the bladder has not been laid hold of. The surfaces of the blades of the forceps are then directed towards the edges of the wound, the left hand placed on the joint, and with a continued gradually increasing pull, accompanied at the same time with waggling movements obliquely from above downwards, the forceps, together with the stone, are drawn out. If during the extraction the edge of the wound be stretched very tightly over the stone, it must be held back with the finger of the left hand.

2096. The obstacles which occur in grasping and drawing out the stone depend on its position and size, on the contraction of the wound of the bladder, on the stone being encysted or adherent, and on its breaking to pieces.

2097. If the stone lie low, it must be attempted by the forefinger of the left hand, passed up the *rectum*, to carry it towards the forceps, or a pair of curved forceps may be used. If the stone be very high, or in the sides of the bladder, it must be tried to change its position with the finger, to thrust it down by pressure on the lower part of the belly, or curved forceps must be introduced; and in using the latter, their handles must always be inclined downwards.

2098. If the stone be grasped in an unfavourable diameter, or too near the joint of the forceps, which is shown by the very great separation of their handles, or if the stone lie with its long diameter transversely within the blades, which is discovered by the slight separation of the handles, and the difficulties in attempting the extraction, the forceps must be opened a little, and with the finger, or with a *bouton* (*b*), it must be tried to give it a better position; 'or it must be dropped into the back of the base of the bladder, and seized afresh. If the wound be too small, though the diameter of the stone be favourable, it must be enlarged, as directed, (*par.* 2094,) to such extent as to render the extraction possible, without much bruising and injury. If the stone be of such size that with even the greatest possible enlargement of the

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(*a*) On the Construction of the various kinds of Stone-Forceps, see Deschamps, above cited vol. iii. p. 200.

(*b*) An instrument like the stilette of a catheter, th a ball at its extremity.

wound it cannot be removed, nothing remains but either to break it to pieces with Earle's (*a*) stone-breakers; or if the stone be not too hard, the outer layers may be broken with a pair of common stone-forceps; or, what is still better, Heurteloup's *percuteur* may be used; or the bladder may be cut into above the *pubes*, which proceeding is always most proper when the stone is very hard. Under these circumstances, also, the extraction of the stone has been recommended to be *made subsequently*, (*Steinschnitt in zwei Zeitraümen*, Germ.; *Taille en deux tems*, Fr.,) when suppuration has commenced in the wound; the extraction, however, is never thereby rendered easier, and this practice is in general to be rejected. Small stones may also lie so between the blades of the forceps, that the handles are not separated, and the operator thinks he has not grasped the stone; in withdrawing and accidentally turning of the forceps, such stone may remain concealed within them, without the operator being aware of it, as I myself have observed. The gush of urine, after cutting into the neck of the bladder, may also throw out a little stone. Small stones can often be well seized with a pair of dressing-forceps, or with flat-bladed stone-forceps.

Campana (*b*) considers the extraction of the stone more easy and less injurious, if it be grasped by its largest diameter.

[If after the entrance of the gorget into the bladder, the urine do not immediately flow out, as it usually does, though less frequently when the internal wound is made with the knife only, it does gush forth suddenly as soon as the forceps are introduced; " not impelled," says Brodie, " by muscular exertion, but by its own gravity and the pressure of the *viscera*. Under these circumstances, when you introduce your finger into the bladder, you find the muscular tunic relaxed, and the mucous membrane hanging in folds; and in consequence they are not likely to be ruptured. In other instances, the patient voids his urine immediately before the operation, or perhaps during the introduction of the staff. Here, the urine having been made to flow by the patient's own efforts, the muscular tunic is contracted; it offers a considerable resistance to the opening of the forceps, and is liable to be ruptured, if the blades are opened rudely and incautiously." (pp. 317, 18.) A case of this kind Brodie mentions, in which " the bladder (as he supposed) was in a contracted state, and the Surgeon, in opening the forceps, observed a resistance, which suddenly gave way, as if a ligature had been broken." * * * On the third morning after the operation, he died, and on *examination*, it was " found that the mucous membrane and muscular tunic of the bladder had been ruptured to the extent of three quarters of an inch." (p. 304.) I have, very recently, in operating on a child of nineteen months, been inconvenienced by the violent contraction of the bladder which Brodie mentions, and to a degree of which I had no notion. I had operated with the cutting gorget, and introduced the forceps with perhaps a little more difficulty than usual, and immediately found the stone; but on attempting to open their blades, I found it impossible without using force, which was not justifiable. I passed the blades farther in, drew them back, gave them a quarter turn, each time endeavouring to open them, but in vain; they were as firmly closed as if they had been tied together, and a momentary thought passed through my mind, that they might have escaped from the gorget, and slipped between the bladder and *rectum*; however, feeling the stone distinctly, again and again, I was convinced that could not be the case, and that the blades were fairly in the bladder. I continued making gentle attempts to open them, and full five minutes elapsed before they would move at all; they then began slowly to open, and at last sufficiently to allow the stone to get between them, when it was extracted, though not before it had slipped once or twice, as I could only at first catch hold of the edge, the principal part of the stone seeming to have been lodged in a fold of the bladder, from which I could not disengage it. Now, had I violently attempted to open the forceps in this case, I should undoubtedly have torn the bladder, as in that mentioned by Brodie; but using only gentle efforts, the bladder yielded slowly, and the operation was safely completed.—J. F. S.]

(*a*) Med.-Chir. Trans., vol. xi. p. 69. pl. iii. 18.

(*b*) von Graefe und von Walther's Journal, vol. v. p. 171.

2099. When the stone is enclosed by a diseased contraction of the bladder, attempts must be made to free it by introducing the finger, or a pair of stone-forceps, the blades of which must be opened in different directions before the stone, so as to separate the walls of the bladder. For this purpose, forceps with several arms, capable of being applied singly have been proposed (*a*). If the stone cannot in this way be grasped, its extraction must be given up, and the spasm attempted to be removed with antispasmodic remedies, fomentations, and the like.

2100. If the stone be encysted, the operator carries his forefinger to the stone, and endeavours, if the encystment be not considerable, to set it free. If this be not possible, on account of the opening of the cyst being very small, a narrow blunt-pointed bistoury, or a bistoury concealed in a sheath and a little curved, must be passed in upon the left forefinger, and in its passage attempts must be made to lay open the cyst to such extent as may be necessary for setting the stone free, which if its position allow, may at the same time be raised by the introduction of an assistant's finger into the *rectum*.

Stones which lodge in the ureter and project into the bladder must be loosened with the finger, carefully seized with the forceps, and attempted to be freed by gentle pulling; as every violent pull is extremely painful to the patient, and drawing the stone towards the neck of the bladder troublesome, however large the wound may be.

If the stone lie in a hollow, formed by the protrusion of the lining membrane between the fibres of the bladder, it must be attempted to enlarge the opening of communication by introducing a pair of small forceps, and then to draw out the stone. The difficulty in doing this will depend upon the nearness or distance of the stone from the wound. If the stone be covered with the inner coat of the bladder, in which case it has been thrust between the membranes at the orifice of the ureter, nothing can be done except proceeding as with a partially encysted stone, or it may be grasped with the forceps, and drawn out with careful movements.

When a stone is covered with fungosities, the finger is to be carried between it and the wall of the bladder, their connexions separated, and the stone pulled out by moving it in different directions, and if the connexions be very firm, it must be attempted to loosen the remaining part by frequent injections, and by shaking the patient, and afterwards to extract the stone (*b*).

2101. With a brittle and easily-breaking stone, it must be endeavoured, by the introduction of the forefinger between the handles of the forceps, to prevent them being too firmly closed, to avoid breaking the stone; and for this purpose various apparatus, as forceps with a bag to catch the stone, and so on, were formerly proposed. When, however, the stone has been broken, the larger pieces must be removed with the forceps, the smaller with a scoop, and the little pieces by repeated injections, with warm water from a clyster-syringe, the pipe of which is to be passed into the bladder on the forefinger. KLEIN (*c*) advises that, in this case, as also when numerous little stones have been removed, the bladder should always be examined with the sound some days after, for the purpose of ascertain-

(*a*) DESCHAMPS, above cited, vol. ii. pl. i. fig. 14, pl. vi. fig. 8, 9.

(*b*) KLEIN; in LODER'S Journal, vol. iv. p. 564.

(*c*) Above cited, p. 380.

ing that nothing remains behind. If the stone break when it has been brought into the outer wound, it must be pressed out by the left forefinger in the *rectum.*

2102. When the operation is finished the *perinæum* must be cleaned, the patient freed from the ligatures, and several turns of a bandage passed round above and below the knees, to keep the thighs together. He must be kept in bed, lying on one or other side, or on his back, with the thighs drawn up and the knees supported. A moist sponge is applied to the wound, and oiled silk or folded cloths laid to prevent the fouling of the bed by the urine which flows out.

2103. The accidents, besides those already mentioned, in the extraction of the stone which may occur during the operation and require particular treatment are, bleeding, injury or prolapse of the *rectum*, convulsions, and fainting.

2104. *Bleeding* may happen from the superficial perinæal artery or its branches, from the transverse perinæal artery, from the inferior or from the internal hæmorrhoidal artery, from the internal pudic artery, from wounding the bulb of the *penis,* and from the posterior or inferior vesical arteries.

The branches of the superficial perinæal artery can only produce an alarming bleeding in those cases where it is unnaturally large. The transverse perinæal artery lies so near the *ramus ischii* that it cannot easily be wounded, if the cut be made at the proper height (*par.* 2078.) The inferior hæmorrhoidal artery is sometimes injured when it is farther forwards than usual, or the cut is continued beyond the line from the *anus* to the ischial tuberosity. The branches of the internal hæmorrhoidal artery spreading between the neck of the bladder and the *rectum* may bleed. The internal pudic is wounded when the cut is made too far to the side. The vesical arteries may be wounded if the prostate be completely cut through, and the body of the bladder itself cut into.

The bleeding from the superficial vessels of the *perinæum* may be stanched by tying them; but that from the deeper vessels requires cold applications, and if these be insufficient, compression must be made with a silver or elastic tube, open on both sides, and with a linen bag attached to its front part (*canule à chemise.*) The front end having been pushed into the bladder, lint is passed between the tube and the linen bag, till sufficient pressure is made on every part of the wound, and the other end of the tube is fastened externally with a T bandage. ERARD (1), DUPUYTREN (2), and VON GRAEFE (3), have recommended particular compressors for this purpose.

The injury of the internal pudic artery may cause so considerable bleeding that the extraction of the stone must be deferred; pressure, in the way prescribed, will, however, always be successful in stanching the bleeding. It has been also advised to keep up pressure with the finger by relays of assistants, or to tie the artery by means of a particular kind of needle (*a*), or with DESCHAMP's (*b*) artery-needle. According to my own experience, however, the continued and efficient application of cold is the best mode of stanching bleeding after cutting for the stone; I have succeeded with it when pressure had been used in vain (*c*).

(*a*) ZANG, Operationen, vol. iii. pl. ii. f. 5.
(*b*) BOYER, above cited, p. 435.
(*c*) Heidelberg klinisch. Annalen, vol. vi. part iv.

(1) **Erard's** (*a*) compressor consists of a canula, at the vesical end of which are two wings, which jut against the inner wound, whilst a plate furnished with compresses is pressed against the *perinæum* with a screw.

(2) Dupuytren's (*b*) compressor has two branches, flat on their inner, convex on their outer surface, and by their elasticity capable of separating from each other like the branches of common dissecting forceps. The branches are covered with leather and agaric, the latter upon their convex surface. The instrument is to be passed, closed, into the wound, the one branch put against the seat of the bleeding vessel, and then the branches allowed to open. If the bleeding stop, the instrument must be left there; but if otherwise, its position must be altered till the bleeding vessel is fully compressed.

(3) von Graefe's (*c*) compressor resembles Weiss's speculum, and consists of four branches, the outer surface of which is covered with agaric: it is introduced, closed, into the wound, and then the branches opened by a screw, so that a regular pressure is made on every part of the wound.

Shaw (*d*) has described a case of fatal bleeding, in operating for the stone, from wounding the dorsal artery of the *penis*, which was given off as a large branch from the hypogastric artery in the prostate gland, and was continued under the pubic arch to the *penis*. He has found this variety of the artery frequent, as has also Tiedemann (*e*) and Burns.

[With regard to the loss of blood during the operation for the stone, Brodie says:—" I have sometimes heard it observed, when a patient has lost a good deal of blood at the time of the operation, that he has lost no more than it will do him good to lose." I have, however, great doubts whether even in the case of the strongest man, the losing much blood adds to his chance of recovery, and it is evident, that in the case of a person of originally weak constitution, or of one whose bodily powers are exhausted by his previous sufferings, or who labours under disease of the kidneys, or other organs, the loss of a considerable quantity of blood in the operation, is likely to make all the difference between its success and failure." (p. 335.)

As to the bleeding which occurs during the operation; though free, it often ceases almost immediately after the patient is unbound, and the legs brought close together, and requires nothing further. But if it continue, and the patient become faint and pallid, it will be necessary to put a stop to it, otherwise the bleeding will be fatal. Brodie mentions the case of an elderly man with an enlarged prostate and deep *perinæum*, in whom " the blood seemed to proceed from the neighbourhood of the neck of the bladder, and what was remarkable, it was venous. He was foiled in all his attempts to restrain the hæmorrhage, and the patient survived the operation only a few hours." (p. 335.) I have also known a case or two in which the bleeding was fatal; but such instances are rare.

When the bleeding continues after the operation, the wound must be gently opened and carefully examined. If any vessel can be seen, it should be taken up and tied; but if, as is more commonly the case, the transverse perinæal artery, or the artery of the bulb, which I believe is far more frequently the bleeding vessel than the pudic, which lies so protected by the *ramus* of the *ischium*, that it is scarcely possible to be injured with the gorget, though it may be cut through with the knife, be cut off close to its origin from the internal pudic, there is not room to apply a ligature around either of the former; and with regard to the pudic, it is next to impossible to get at it at all with a needle. In such cases the best and safest proceeding is to pass the finger into the wound, and press the artery steadily against the *ramus ischii* till the bleeding cease. This will require to be continued for several hours, and will need a relay of assistants. I have seen two cases so treated successfully. The first case was under my care during my dressership, and the pressure was kept up uninterruptedly for fourteen hours, and with very little inconvenience to the patient. Attempts had been made both to tie the vessel, and to cut it across, so that its ends might retract, as it was supposed to have been merely wounded, but they were quite fruitless. In the other case, four or five hours were sufficient to put the patient in safety. Under these circumstances the surface of the wound generally sloughs, and the cure is retarded.

Sometimes, the blood instead of escaping by the outer wound, flows back into the bladder, and forming a clot, prevents the passage of the urine either by the wound or

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(*a*) De l'Hemorrhagie à la suite de la Taille, &c. Paris, 1822.

(*b*) Mémoire achevé et publ. par Sanson et Begin, p. 50.

(*c*) Journal von Graefe und von Walther, vol. xxii. p. 65.

(*d*) London Med. and Physical Journal, vol. lv. p. 2. 1826.

(*e*) Tabulæ Arteriarum, pl. xxx. f. 2.

by the *urethra.* I have known this happen in a few instances, without the bleeding however being serious, or affecting the constitutional powers. If the patient do not pass water in the course of a few hours after the operation, if he become restless, and if there be fulness and uneasiness, or pain about the region of the bladder, it may be suspected, that blood has flowed into the bladder and clotted. It is then necessary to pass the finger gently through the wound into the bladder, and immediately this is done the urine escapes and clots of blood with it. Should the bladder be found much distended with blood, it is well to wash it out gently with a syringe and warm water, which may be repeated once or twice, at intervals, according to circumstances.

Plugging the wound, or other of the appliances mentioned by CHELIUS, I do not think at all proper.

Secondary bleeding, in rare cases, follows at an interval of several days after a patient has been cut for the stone. BRODIE mentions one of a child in the second week, which occurred under his own care, and though the boy was excessively lowered by the bleeding, he recovered. Also a case of EARLE's, which bled on the seventh or eighth day, and was stopped "by introducing through the wound into the bladder, a tent composed of a quantity of lint wrapped round an elastic gum catheter." (p. 335.) The first case of this kind which I witnessed was under my care during my dressership in 1816, and had been operated on by the elder TRAVERS. At the time of the operation much blood was lost, but it soon stanched. On the *fourth* day there was a sudden bleeding from the wound, to the amount of a pint and a half, which was stopped by pressure with the finger. On the following day the bleeding returned twice, and he lost another pint of blood; pressure was again made for five hours; the bleeding was not repeated, and he recovered. A similar case occurred to GREEN, in 1841, in a boy of thirteen. He became excessively faint very soon after the operation, and there was a little bleeding throughout the whole of the afternoon and day following, which was checked by the introduction of the finger, with pressure on the pudic artery for about half an hour at a time. No farther bleeding occurred after the second till the ninth day, when he became very restless, and there followed a very free bleeding, both from the wound and from the *urethra;* several clots were passed during the afternoon and evening, the finger having been introduced into the wound several times to favour their escape. There was no recurrence of clots or bleeding after this day. He was kept low for some days, but no cold application used, and he recovered.

The following fatal case of secondary bleeding happened to me in 1839:—I had operated on a lad of thirteen years of age with the gorget, and in opening the staff had cut through either the transverse perinæal or the artery of the bulb, from which there was very free bleeding, but it soon ceased. On the evening of the *second* day he had pain in the region of the bladder and in the left groin, with tenderness and a good deal of constitutional excitement. Leeches were applied to the belly. The symptoms continuing, calomel and opium were ordered on the following day, and he was so much improved on the fifth day that the mercurial was left off, there remaining only a little tenderness in the left groin. His urine was now quite natural in colour. On the *sixth* day, up to which time he had passed water plentifully both by the wound and by the *urethra,* a thin slough about the size of the finger-nail came away, and he seemed doing very well; but about noon he had some pain at the lower part of the belly, which was immediately followed by a small motion, accompanied with much straining; and as the urine passed by the wound, a quantity, as much as would fill both hands, of very offensive dark-coloured clotted blood escaped with it. He then became easy, but was very faint and pallid, and it was necessary to give him some brandy. On the next day he was tolerably well, free from pain, and did not seem affected by the occurrence of yesterday. It was thought that the clot discharged might have depended on bleeding back into the bladder, and that this had been the cause of the irritation on the second evening. On the *seventh* evening he had a good deal of straining, and passed by the wound about three table-spoonfuls of clotted blood in several lumps, with plenty of water. On the following morning he passed some bloody urine after straining, and the napkin was slightly tinged with fresh florid blood; he was pallid, his pulse small and quick, and the countenance rather anxious. The same evening, with much straining and a little motion, he passed a clot of four ounces, another an inch a half long, and as thick as the finger, and a third and smaller clot, at three several times. On the morning of the *ninth* day, about half-past seven, with much straining and a little motion, he passed about four ounces of clot with urine by the wound, and a little blood, but no water, from the *urethra.* He then became very faint and squeamish, and yawned continually, his countenance bloodless, and his pulse very weak and quick. I carefully examined the wound, and found it clean but pale, with a small layer of coagulated blood on the left side, which being disposed to stick, I thought best to leave alone. Between this time and three in the afternoon his bowels were sparingly moved five times, and he had passed plenty of water, but neither blood nor clots. On consultation with my colleague, Green, it was determined that the finger should be introduced into the bladder, and any clot there detached and broken to pieces, and cleared out by injecting warm water, that the bowels should be quieted with opium, and his powers supported with egg and wine. This was accordingly done; I introduced my finger, but could not ascertain anything unusual; no water, but a small portion of clot, not larger than half a sixpence, followed its withdrawal. I then passed a catheter by the *urethra*, and with my finger in the wound, introduced it into the bladder, and injected by it some warm water twice, the first passed by the wound slightly tinged, but the second was colourless; and the catheter when removed had no appearance of having been in any clot. He slept during the rest of the day, and neither had any more straining nor passed blood, though the napkin was a little stained. About eleven he threw up some beef tea immediately after taking it, as well also porter and brandy and water, which were given at intervals, and then dropped asleep. At four o'clock on the morning of the *tenth* day his bowels were freely moved without any clot, and soon after he took and kept down an egg and some tea. In the course of the forenoon he passed plenty of water, accompanied with a very offensive discharge, as if from a slough, but without any blood, and seemed better though very languid. As he was fully under the influence of the opium I directed its omission, thinking it might be perhaps the cause of the sickness. At noon he was seized with shivering and seemed to be passing his water; the wound was looked to, a small clot found in it, which being removed, the urine escaped readily, and the shivering ceased. During the day he took some beef tea, porter, and egg, which he enjoyed, and was constantly dozing. He had one motion with much straining, but unaccompanied with bleeding or clots. On the *fifteenth* day he continued improving, except that the straining continued, for which an opium injection was given with advantage, and he has taken plenty of nourishment, to which first port wine was added, but afterwards changed for sherry. The wound has become more florid and suppurates freely, and there is a plentiful discharge of *mucus* from the bladder. Everything seemed doing well, and the quantity of *mucus* diminishing up to the *twenty-first* morning at five o'clock, when the napkin was found stained with bloody urine, and a little bright red blood; he passed more bloody water and a little bright blood several times. At nine o'clock a small clot passed, at ten another and soon after a motion, and about two table-spoonfuls of clot, and he began to feel faint. Clots and water continued passing at intervals till eleven o'clock, and between that time and noon about six ounces more. Soon after he passed another clot from the wound, and some bright blood by the *urethra*. He then became very pallid and cold and his pulse very small and quick. I passed a catheter and washed out the bladder; the first water was tinged with blood, but the second was clear; under these circumstances I thought it best to introduce the finger into the wound and compress the pudic artery, which being found efficient was continued for twenty-one hours, a very small clot or two only passing when the finger was withdrawn for relief. Brandy and beef tea and a few drops of laudanum were given during the day, as he had become very restless. On this evening (the *twenty-second*) he was attacked with some bronchial irritation, which continued increasing, not having been relieved by the application of mustard poultice or blister, as he was too weak for any more active means. He continued sinking, and died on the afternoon of the *twenty-fourth* day, but had not had any recurrence of the bleeding. The *examination* of this case was most unsatisfactory, as the parts which had been removed that they might be carefully examined, were cut to pieces in the neighbourhood of the pudic artery, which was the most important of all. I was therefore unable to ascertain whence the bleeding had originated; but I cannot help thinking it must have been from the origin of the transverse perinæal artery, and that had I made pressure on it at first, as I did at last, the boy might have been saved. This plan I should certainly adopt under similar circumstances. At the time I did not recollect the occurrence of after-bleeding in a case of this kind, and when the bleeding ceased for a time and the child again began to improve, I had hoped that the danger had passed away. The case is deeply interesting, and I believe not undeserving the full report I have given of it.—J. F. S.]

2105. *Wounding the rectum* may happen in various ways: *First*, at that step of the operation when the operator having made the outer cut, carries the point of the knife into the groove of the staff for the purpose of opening the membranous part. If the handle of the knife be then too much raised, its point sinks into the *rectum*. This opening is in general very small, a mere puncture, through which only the intestinal gas and a small quantity of fæcal matter escapes into the wound. *Second*, when in withdrawing Frère Côme's lithotome or the common bistoury, the wound first made, is still increased. The pain which accompanies cutting through the neck of the bladder often excites the patient to strain violently, and thereby force the intestines violently into the *pelvis*, so that the *rectum* lies as a fold before the prostate. In old persons there is sometimes an enlargement of the *rectum*, so that the prostate is usually lodged in a hollow of the gut, which also surrounds the neck of the bladder on both sides. In such case the *rectum* must be almost necessarily wounded in the withdrawal of Frère Côme's lithotome. If the gut receive the prostate only on one side in such hollow, it is advisable to operate on the right side, and with great care (*a*). *Third*, the *rectum* may be wounded in drawing out a large angular stone; if the wound be small, and near the *m. sphincter ani*, and the patient young, strong, and healthy, the opening frequently closes of itself without symptoms. Sometimes a fistulous opening remains after the wound in the neck of the bladder, and the membranous part of the *urethra* has closed, and communicating with the gut like a common rectal fistula, is to be treated in the same manner. Occasionally, the external wound closes, and there still remains a communication between the neck of the bladder and the *rectum*, which, however, is in general so contracted, that but little urine passes through the *rectum*, and only a small quantity of fæcal matter by the *urethra*. Desault and Dupuytren have in such cases divided the *rectum* from the wound with success. The common practice is to introduce an elastic catheter into the bladder. According to Kern (*b*), in a wound of the *rectum* corresponding to the body of the bladder, the buttocks should be raised, frequent injections of warm water, and drawing off the urine several times a day with the catheter, should be practised.

The bladder is placed higher in children than in adults; therefore, as the parts are cut through from without inwards, or from within outwards, a direction must be given to the instrument, corresponding to a line supposed to be drawn from the navel to the haunch-bone, so as more certainly to avoid injuring the *rectum* (*c*.)

[Wounding the *rectum* in performing the operation for the stone is, as far as I know, of rare occurrence. I have seen but two cases in the course of thirty-three years; one was done in introducing the gorget, and the other in making the second cut with the knife before the gorget was introduced. The Surgeons under whose care they were, wisely left them alone, and treated them as if no accident had happened. A little fæculent matter passed by the wound in the *perinæum* for a few days, after which the *rectum* scarred, and no farther inconvenience ensued. I have never seen any instance in which division of the *sphincter ani* was requisite, and I doubt whether in England such ever occurs. Should I ever meet with a recent case of the kind, I should advise leaving it to nature.—J. F. S.]

2106. When the *rectum* is protruded by the patient straining during the operation, it must be pressed back and retained by an assistant with a pad upon the right side.

Convulsions and fainting require the operation to be quickly finished, and if that be not possible, and the patient's danger great, the extraction of the stone must be put off.

2107. The *after-treatment* in general consists of cooling and mild remedies. The patient should take an opiate after the operation, and must

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(*a*) Deschamps, above cited, vol. iii. p. 8.

(*b*) Above cited, p. 239.

(*c*) Dupuytren, above cited, p. 28.

preserve the most perfect rest of body and mind; for drink he should take a little almond milk, and for food only a little broth, for the first few days. The sponge on the wound should be frequently changed, and the neighbouring parts kept clean. In general the urine begins to flow partially by the *urethra* the first day after the operation; when the urine is mostly voided by the *urethra*, the wound should be covered with wadding, which is to be fixed with a tightly drawn T bandage, and towards the end of the scarring the wound must be touched with caustic to promote its healing. The cure of the wound is often complete in three or four weeks; sometimes it occupies a month; but in rare cases the wound closes by quick union in from *nine to fourteen days* (*a*). I have twice seen the wound healed by agglutination on the fourth day (*b*).

The continued application of cold by means of a large sponge dipped in very cold water, is obviously the most efficient remedy to prevent bleeding and severe traumatic reaction.

[The dextrous performance of the operation for the stone is not all that is necessary for the well-doing of the patient, and instances have occurred within the remembrance of many, in which, though ably and quickly performed, and with as little suffering to the patient as possible, and every hope of a favourable result when they were removed from the operating-room, yet have they terminated fatally. In hospital practice, I have no doubt this has arisen from stone-patients having been, in most instances, placed in a ward with other patients, where sufficient quietude could not be preserved, and where the sister having only occasionally a single case, had no chance of obtaining sufficient experience in the conduct of a case, which mainly depends on her constant attendance and ability, almost as much, indeed, as upon the good performance of the operation. In consequence of so much being intrusted, of necessity, to the sister, and so little which might attract attention being done, few students, on leaving the hospital, know more of a stone-case than the performance of the operation and its result, unless any thing very remarkable should occur during the course of the cure; and therefore, when settled in practice, and called upon to operate for the stone, although they may perform the operation extremely well, yet they are at a loss to know in what way the after-treatment, under common circumstances, should be conducted; and are therefore unable to give directions, or to exert such control over the nurse as may assist to bring about a favourable termination of the case. I am not aware that either in any Lectures on Surgery, or other published works, that these seemingly trifling, though, in reality, very important points in the after-treatment of stone-operations have been noticed, the attention only having been drawn to after-bleeding, peritonæal inflammation, and some other more striking circumstances of such cases.

To fill up this serious gap in the after-treatment, I shall now relate the practice which certainly for the last forty-six years, and I have little doubt for a much longer period, has been adopted at St. Thomas's Hospital.

When a patient is ascertained to have the stone, he is placed in a small ward, containing only half-a-dozen beds, and which, during the first part of the after-treatment, is kept private and extremely quiet. Here he remains under the watchful eye of the sister, an experienced woman, to whom all the stone-cases are assigned, and who is capable of giving the Surgeon a full and sufficient account of the patient's symptoms and sufferings during his absence, and to note any little peculiarity about him, which a nurse unaccustomed to such cases would overlook. Great care is taken in first instructing these women, who usually remain long in this ward; indeed, in thirty-six years the sister has been replaced only thrice since the death of the sister who had the ward when I first entered the profession, and who spent twenty years there: a sufficient proof of the experience which such persons must acquire.

The patient usually remains for ten days or a fortnight, to accustom him to the place and to his attendants; and it is rarely requisite to pay more than ordinary attention to his diet and habits, if he be in good health, excepting his immediate complaint. If his sufferings be severe, an occasional hip-bath is used, which has a very soothing effect; and is often extremely serviceable if the preparatory soundings increase, as they will occasionally, his sufferings. I have rarely known it necessary to employ blood-

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(*a*) Textor, above cited, p. 34.—Graefe in Bernstein, p. 100.

(*b*) Chelius, Ueber den Steinschnitt; in Heidelb. klin. Annalen, vol. vi. part iv.

letting or other depleting means, though such necessity may possibly occur, but in ordinary cases they are unneedful and improper. An occasional clearing of the bowels is, however, requisite; and if the patient have been accustomed to take gin and water, for promoting the action of the kidneys, a practice, with regard to young stone-patients especially, very prevalent, it will be well not to deprive him of it at once, or he will become fidgetty and uncomfortable, but to diminish it slowly, or even to continue its use.

Under ordinary circumstances, a stone-patient should not be operated on, except his health be otherwise good. His sufferings from the disease itself will call for the performance of the operation. The state of the atmosphere should, as far as possible, be considered. Temperate weather is the most favourable; for if it be very hot, the patient, in the weak state he usually is after the operation, suffers much from its depressing effects; and if it be very cold, he is liable to chill in the necessary frequent uncovering to which he must be subjected to keep him dry during the after-treatment.

On the day previous to the operation, a dose of castor oil should be given to clear the bowels, and the diet restricted to rice pudding and milk, with plenty of barley water or gruel, but the former of the two is most preferred. If the motions be hard and lumpy, castor oil is added to an injection of gruel, which must be thrown up on the morning of the operation, but if not, a simple injection of gruel is sufficient for the purpose of completely relieving the lower bowel.

Immediately after the operation, the patient is put to bed, with his legs straight and close together, by which the surfaces of the wound are brought gently together, and any slight disposition to bleeding checked. A napkin is passed round the *pelvis*, and brought up between the legs, in the same way as healthy infants are commonly clouted. As it is of great importance that the patient should be kept dry, the napkin is changed every time any urine passes by the wound, and attention is paid to this through the whole course of the treatment. On the evening of the operation day, or the following morning, if there be no bleeding, a piece of lint, folded on the end of the finger, is introduced into the wound, and pressed up the depth of the *perinæum;* this is also replaced every time the patient wets, and is continued till the wound heals; its object is to ensure the healing of the wound from the bottom, so as to prevent, as far as possible, the production of any fistulous passage, which, under this treatment, is of very rare occurrence. A handful or two of camomile flowers thrown into a basin, are sprinkled with spirits of wine, well mixed, so as to be equally moistened, and then put into a thin flannel bag, and, having been well heated on a warming-pan, are applied over the belly as hot as the patient can bear, on the evening of the operation day, if there be no bleeding; and this is continued for a week or ten days. If, as sometimes happens, on the second day the wound be swollen, and the urine do not flow through it, no lint is introduced, but a bread-and-water poultice applied, and, as the swelling subsides, the water escapes by the wound. Such is the usual mode of proceeding, and neither is the bed guarded with oiled silk, nor cold sponge, nor any other cold applied even though there were bleeding. Rarely, except under particular circumstances, is any opiate given throughout the cure. The diet for the first two or three days should consist merely of rice or sago pudding, biscuit, toast and tea, or arrow root and milk, with a plentiful supply of barley water. As the bowels had been freely relieved, it is unnecessary to give any medicine before the third day, and then only a little castor oil to act gently. But if there be pain in the belly, or sickness, then the oil must be given earlier, and usually it subsides when the bowels are moved. The urine at first passes frequently by the wound; but usually about the third or fourth day also comes by the *urethra;* and as more continues to pass by the latter, so does less escape by the former, and, in about a week or ten days, the wound of the prostate having healed, the water passes only by the natural passage; and when this happens, the wound is dressed with wax and oil upon the lint introduced, as before. In one instance I have known the water cease to pass from the wound after twenty hours, but this is a rare occurrence. Generally, when the water does not at first flow from the wound, the patient becomes irritable and uneasy, and it is well to introduce the finger, so as to break up any little clot which may stop up the wound, after which it usually escapes freely. Occasionally it may be necessary to resume the gin and water, if the patient flag, which, however, the Surgeon himself will attend to in reviewing the state of the health. The patient should be kept in bed some days after the water has ceased to flow by the wound, or, in other words, till it is nearly healed to the surface. If a small *sinus* should continue open, it is well to twist up a little piece of lint corresponding to its size, which should be dipped in a solution of sulphate of copper, and gently screwed up to its bottom; but, in most cases, a simple dressing of wax and oil is all that is needed. Commonly, in from three weeks to a month, the cure is perfected; the diet having been gradually improved, and porter or wine added according to circumstances.—J. F. S.]

2108. When, after the operation, there is reason to fear active inflammation, it must be sought to prevent it by general and local blood-letting, and by the constant use of cold applications to the *perinæum*. If inflammation arise, which commonly spreads over the *peritonæum*, it must be met with corresponding antiphlogistic treatment (1). It most commonly depends on the escape of urine into the cellular tissue of the pelvic cavity, when the capsule of the prostate has been opened by a large cut, or by tearing. Old persons, in whom the walls of the bladder are thickened, or otherwise diseased, often die without any active inflammatory symptoms coming on. Opiate clysters and blisters to the belly are proper in these cases (*a*). In an erethetic state, which shows itself by a very great degree of general uneasiness, by great wearisomeness of the whole body, by dull pain in the loins, and depression of the powers, with small, contracted, faltering pulse, cooling and mild treatment must be first employed, together with warm bathing and oily mixtures, and if any one organ be specially affected, leeches must be at the same time applied to it (*b*). Spasmodic symptoms require antispasmodic remedies alone, or in connexion with antiphlogistics, if there be accompanying inflammation. A painful discharge of urine by the *urethra*, or its complete obstruction may be caused by spasm, by swelling of the wounded parts, or by a collection of clotted blood. According to the variety of the cause, the remedies must be either antispasmodic or antiphlogistic, and the urine must be emptied through the wound by a female catheter passed into the bladder.

[(1) "It is a prevailing opinion," says Key, "that stone-patients die of *peritonitis* brought on by the injury done to the bladder during the operation, a mistake which, though not leading to any serious error in the after-treatment, is so far attended with mischief inasmuch as it misleads the Surgeon from the true cause of the fatal event. I will not venture the assertion, that inflammation of the *peritonæum* is never a *sequela* of lithotomy, but that it is an extremely rare occurrence, and still more rarely the cause of death, examinations *post mortem* have fully convinced me. During the ten years I have been at our hospitals, I have never yet seen an unsuccessful case, examined after the operation, in which inflammation of the *peritonæum* could be regarded as the cause of death; and as invariably I have found that one circumstance was uniformly present, namely, suppurative inflammation of the reticular texture surrounding the bladder. * * * Inflammation spreading rapidly through these cells will quickly affect a surface much greater than that of the *peritonæum*, and I have witnessed," says he, "symptoms as acute, pain as severe, and the peculiar depression attending *peritonitis*, as marked in the reticular inflammation as in the most acute and fatal case of inflammation of the abdominal cavity. * * * In the inspection of those who die after lithotomy, it is not sufficient to look into the peritoneal cavity, to open the bladder, or to examine the state of the wound; the *peritonæum* lining the lower part of the abdominal muscles should be stripped off, and the source of evil will be then laid open. The finger will enter a quantity of brick-dust coloured pus in the cellular substance around the bladder, and if considerable force has been used in the extraction of the stone, will readily find its way towards the wound in the *perinæum;* the barrier between the adipose structure of the *perinæum* and the reticular texture of the *pelvis* being broken down, the suppurative inflammation spreads rapidly along the latter, and may be traced, in some cases, between the *peritonæum* and abdominal muscles as high as the *umbilicus*, in one case I have seen it extend to the diaphragm." (p. 18–21.)

"All that I have been able to observe for many years past," says Brodie, "has confirmed me in the opinion, that *an incision of the prostate, extending into the loose cellular texture surrounding the neck of the bladder, is replete with danger to the patient.* Such a division of parts is never necessary where the *calculus* is of moderate dimensions; but it cannot be avoided where it is of very large size; and hence the extraction of stones of

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(*a*) Samuel Cooper, First Lines of Surgery, p. 775. Seventh Edition. 1840.

(*b*) Zang, above cited, p. 239.

this description can never be accomplished without a great probability of the patient not surviving the operation.

"The symptoms which arise in these cases are not well marked in the first instance. There is some heat of skin, and generally an absence of perspiration; there is usually an abundant flow of urine through the wound. The pulse, as to frequency, is somewhat above the natural standard; and the patient, although free from suffering, has no disposition to sleep. This state of things continues for twenty-four or even forty-eight hours after the operation; then the more characteristic and alarming symptoms show themselves. The pulse becomes more frequent, rising to 90, 100, and at last to 140 in a minute; the heat of skin becomes still greater, the tongue dry, the countenance anxious. Afterwards, as you count the pulse, you find every now and then a beat weaker than the rest, and then there are complete intermissions. At first the intermissions are not more than one or two in a minute; by degrees they become more frequent, until they occur every third or fourth beat. There is an occasional hiccough; the patient complains of some degree of tenderness in the lower part of the *abdomen*, especially in the left groin; the belly becomes tympanitic, that is the stomach and intestines are filled with air, the distension of the belly increases, the hiccoughs are more frequent, the pulse continuing to intermit, becomes weak and fluttering. In some instances, the patient retains his understanding even to the last; while in others he falls into a state of low delirium previous to death. Occasionally in the progress of such a case, the patient has a severe rigor, and sometimes he complains of a pain in the loins. Where these symptoms begin at an early period, he may die within forty-eight hours from the time of the operation; but in other cases, death may not take place for four or five days, or even for a week. On dissection you find the cellular membrane round the neck of the bladder, and between the prostate and the *rectum*, bearing marks of inflammation, infiltrated with lymph and serum, and to a greater or less extent, converted into a slough. If death has taken place at an early period, the intestines are found distended with air, and there is a very slight effusion of serum in that part of the *peritonæum*, which descends into the *pelvis*. But if the patient has laboured under these symptoms for many days before he dies, the *peritonæum*, where it is reflected from the bladder to the *rectum*, is seen of a darker colour than natural, and incrusted with lymph; and at a still later period there is the appearance of inflammation, to a greater or less extent, throughout the *peritonæum* generally. But the peritonæal inflammation is evidently not the primary disease; it is the inflammation and sloughing of the cellular membrane of the *pelvis*, which has induced inflammation of the adjoining portion of that membrane. Something also is to be attributed to the tympanitic distension of the intestines, which, if continued for a considerable time, is always liable to be attended with tenderness of the *abdomen*, and some degree of peritonæal inflammation. It is important that you should not fall into the error of regarding such cases as I have just described, as cases of simple peritonæal inflammation; for the remedies which would be useful in the latter case are injurious here. The abstraction of blood, or even the operation of an active purgative, will cause the patient to sink more rapidly, tending only to hasten his death. The proper system to be pursued, is the opposite to that of depletion. The patient should take such nutriment as his stomach is capable of digesting. The bowels may be kept open by injections, or by the exhibition of some very gentle purgative; and ammonia, wine, and brandy are to be administered, when the state of the general system indicates that stimulants are necessary." (p. 327–30.)]

2109. The bleeding which occurs at various periods after the operation, requires a different mode of treatment according to its degree. If slight it may be considered useful as a local blood-letting, and as tranquillizing the patient. A severe bleeding, when coming on soon after the operation, if it do not yield to the use of cold applications, requires the ligature, if the seat of the bleeding vessel will permit it, or pressure as already directed. In this case, as well as when pressure is also applied after the operation, the instrument used must be continued in its proper place, as long as seems necessary for the certain obliteration of the vessel. Bleeding from the vessels of the bladder requires, besides strict rest and a cooling treatment, cold applications to the belly, and in cases of necessity injections of cold water, or solution of alum.

In persons whose blood is thin and watery, their eyelids puffy and semi-transparent, who are often attacked with bleeding from the nose and gums; a constant bleeding often comes on after the operation, which is nearly always fatal, and like any parenchymatous bleeding, must be treated with tonics (*a*).

2110. Abscesses sometimes form about the neck of the bladder, which must be encouraged to discharge their pus. If fistula should remain, it must be treated as already directed (*par.* 2105); frequently it is incurable.

Incapability of holding the urine and impotence, which rarely continue after the lateral operation for the stone, depend upon the great bruising and gangrenous destruction which the neck of the bladder has suffered from the large size of the stone and the violence of the extension. Strengthening remedies, internally and externally, as in *ischuria paralytica*, are the alone means which may here perhaps be useful.

2111. If the disposition to form stone continue after the operation, it must be counteracted by either of the already prescribed rules (*par.* 2011–13).

An instance of remarkable disposition to form stone is mentioned by CHARLES PHILLIPS (*b*), in which in the space of six years, one lithotomy and four lithotripsies were required.

To the works already referred to on the lateral operation for the stone, the following may be added:—

MERY, J., Observations sur la manière de la tailler dans les deux sexes pour l'Extraction de la Pierre, pratiquée par Frère JACQUES. Paris, 1700.

MORAND, S., Opuscules de Chirurgie, vol. ii. p. 51.

GARENGEOT, De l'Opération latérale corrigée. Paris, 1730.

GÜNZ, De Calculum curandi viis, quas FOUBERT, GARENGEOT, PERCHET, LE DRAN et LE CAT reperierunt. Lipsiæ, 1740.

PALLUCCI, N. J., Nouvelles Remarques sur la Lithotomie, &c. Paris, 1750. 8vo.

ALBIN, R. S., Dissert. de variis Calculi secandi methodis. Ludg. Bat., 1754.

CAMPER, Demonstrationes Anatom. pathologicæ, lib. ii.

POUTEAU, Sur l'Opération de la Taille; in Mélanges de Chirurgie, p. 197. Lyon, 1760.

SEILER, Dissert. Cultrorum ceratotomorum et cystidotomorum historia. Wittenberg, 1805.

DÖRNER, Ueber die Wahl einer Steinschnittmethode; in VON SIEBOLD'S Chiron, vol. i. part i.

THOMSON'S JOHN, M.D., Observations on Lithotomy, &c. Edinburgh, 1808. 8vo.

COOPER, SAMUEL; in Med.-Chir. Trans., vol. viii. p. 206.

RICHERAND, Mémoire sur l'Hemorrhagie après l' Opération de la Taille latérale; in Mém. de la Soc. d'Emulation, vol. i. p. 145.

2112. Incidental to the history of the lateral operation for the stone, are the methods of opening the body of the bladder from the *perinæum*, which originated in the attempts made by BAMBER, CHESELDEN LE DRAN, DOUGLAS, and MORAND, to discover RAU'S operation, which was wrongly believed to consist in opening the body of the bladder (*c*). FOUBERT proposed a particular mode of operating, in which, after the bladder had been largely distended by drinking, by injection, or by holding the water, a long grooved trocar was thrust horizontally into the bladder in the middle of the space between the *m. erector penis* and *m. accelerator urinæ*, from two to three lines from the ischial tuberosity and an inch from the *anus*; and after withdrawing the stilette a little, with a

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(*a*) DESCHAMPS, vol. iii. p. 29.

(*b*) Gazette Médicale, vol. ii. p. 534. 1834.

(*c*) DOUGLAS, above cited.—LE DRAN, Parallèle des différentes manières de tirer la Pierre hors de la Vessie, p. 109. Paris, 1730.

peculiarly formed knife carried along the groove of the trocar, the opening into the body of the bladder from below upwards, and in withdrawing the knife the outer wound was dilated. A gorget was then introduced on the groove of the trocar, with which, if necessary, the wound was farther enlarged, and upon it the forceps passed (*a*).

Thomas (*b*) made the cut from above downwards by means of an instrument resembling Frère Côme's lithotome.

2113. The danger of bleeding, the difficulty in extracting the stone, the wounding the *rectum*, and the other accidents, and their consequences which frequently accompany the lateral operation for the stone, have led to the practice of *cutting for the stone through the rectum* (*Lithotomia recto-vesicalis.*) This operation was first proposed by L. Hoffmann (*c*), who gave reasons for its preference over the others, although the proposed operation is more uncertain in its results. Sanson (*d*) claims it as his own discovery, and describes his mode of proceeding. It is in especial favour with Vacca Berlinghieri (*e*) and others, and performed with success.

Martin (*f*) lays claim to the discovery of this operation: he made his first experiment on the dead body in 1786. But Hoffmann lectured on the subject in 1779. That the first notion of the operation of cutting for the stone by the *rectum* cannot be ascribed to Vegetius (*g*), as the Editor of the Article *Lithotomie* in the Dict. des Sc. Medic. vol. xxviii. p. 424, imagines, Vacca Berlinghieri has sufficiently proved (*h*).

["In the case of a thin person, with a stone of so large a size, that the extraction of it by the usual method, would be either impracticable, or attended with the greatest risk to the patient's life," Brodie says, "it may be a question, whether there is not a better method of proceeding (than the high operation) in the recto-vesical operation; in which the incision of the *perinæum* is made to extend through the tunics of the *rectum* and the *sphincter ani* muscle. Here the parts which afford the chief resistance to the extraction of a large stone are divided; and, although the incision of the neck of the bladder extends beyond the boundaries of the prostate, the ill consequences arising from the escape of urine into the cellular membrane, are likely to be in great measure obviated in consequence of the free opening which has been made into the *rectum.*" Brodie performed this operation on one occasion in which the stone was supposed to be very large, but did not so turn out, and the patient, who had suffered from stone more than twenty years, died in about three weeks with abscesses in the kidneys, and on one side of the *pelvis*. (pp. 347, 48.) In another case, a man between sixty and seventy, whom he operated on with Blizard's knife, and on whom with much constitutional excitement, the *abdomen* was tense and swollen, and there was great danger, Brodie cut through the *rectum* with a probe-pointed bistoury on the fourth day, and the patient did well.

Solly, one of our assistant Surgeons, also performed this recto-vesical operation in a case where the stone was presumed to be very large; but it was not large. The case went on well, and recovered without any untoward circumstances.—J. F. S.]

2114. Sanson has proposed two different modes of penetrating through the *rectum* into the bladder. After previously dividing the *m. sphincter ani* and the lower part of the *rectum*, in the direction of the *raphe*,

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(*a*) Foubert, Nouvelle Méthode de tirer la Pierre de la Vessie; in Mém. de l'Acad. de Chirurgie, vol. i. p. 65, pl. i.–viii. Kesselring, Dissert. Historia et examen Methodi Foubertiani pro extractione Calculi. Halæ, 1736.

(*b*) Thomas; in Louis, in Mém. de l'Acad. de Chirurgie, vol. iii. p. 653. Deschamps, above cited, vol. ii. pl. v. f. 12.

(*c*) Von einer neuen Methode den Stein zu schneiden; in Vermischten Schriften, herausgegeb. von. H. Clavet. Münster, 1791. vol. ii. p. 511.

(*d*) Des Moyens de parvenir à la Vessie par le Rectum, avantages et inconvéniens attachés à cette Méthode pour tirer les Pierres de la Vessie. Paris, 1817. 4to.

(*e*) Sanson, Des Moyens de parvenir à la Vessie par le Rectum, &c., suivie d'un Mémoire sur la Méthode d'extraire la Pierre de la Vessie urinaire par la voie de l'Intestin Rectum, de And. Vacca Berlinghieri, traduite de l'Ital. par Blaquière. Paris, 1821. 8vo.

(*f*) Nouvelle Méthode de faire l'Opération de la Taille; in Revue Médicale, vol. ix. p. 225. 1822.

(*g*) Mulomedicina, cap. xlvi. lib. i. Basil, 1574.

(*h*) Above cited, p. 72.

towards the root of the *penis*, the prostate, and part of the lower wall of the bladder is laid bare, and then upon the groove of a staff introduced into the bladder, *the prostate is to be divided in its mesial line ; or the knife may be passed behind the prostate through the wall of the bladder into the groove of the staff and the base of the bladder divided to a certain extent.*

The latter method is fully described by SANSON ; the former is rather indicated. The staff when introduced is to be held upright, the left forefinger, with its volar surface upwards, is to be introduced into the *rectum*, and upon it the blade of a straight bistoury laid flat ; its edge is then turned up, and with a single cut the outer *sphincter* muscle, together with the lower part of the *rectum*, is cut through in the direction of the *raphe*. The groove of the staff is now sought for with the finger behind the exposed prostate, the point of a bistoury introduced upon it, and as it is pushed along the groove, a cut is made in the lower wall of the bladder, which commencing behind its neck, passes in the mesial line to the midst of the space between the two ureters, through which the stone is extracted. VACCA BERLINGHIERI has specially defended the first mode, and has fully set forth his preference of it both by reasoning and experience, so that his essay may be considered the best guide for recto-vesical lithotomy.

2115. The patient must be placed and bound as for the lateral operation ; a staff is passed into the bladder, and given to an assistant, who holds it firmly and perpendicularly, so that its groove corresponds to the mesial line of the *urethra* and the *raphe*. The operator then takes a straight bistoury with his right forefinger and thumb, where the blade meets the handle, and lays its blade flat on the volar surface of the left forefinger, in such way that both its edge and point are covered ; the finger and knife are then passed into the *rectum*, and carried upwards ten or twelve lines, the dorsal surface of the finger corresponding to the hollow of the *sacrum*. Whilst the operator presses the hind wall of the bladder with this finger, he turns with his right hand the edge of the bistoury upwards, and with the forefinger pressing its back, he thrusts its point through the front wall of the *rectum*, and as he withdraws the knife, cuts through the *rectum*, the external *sphincter* muscle and the cellular tissue covering the *urethra*. The operator now leaves the bistoury with the left forefinger, turns the dorsal surface of this finger towards the left and its cubital surface upwards, carries its tip into the wound of the *sphincter*, and places his nail (which in this operation should be always done) in the groove of the staff, which can be felt through the wall of the *urethra*. Guided by the nail of the left forefinger, the point of the bistoury, with its edge downwards, is carried through the wall of the *urethra* into the groove of the staff, and supported on the nail, is pushed forwards in a corresponding direction to the *raphe*, by which the neck of the bladder and the prostate are divided to a greater or less extent, according to the presumed size of the stone. The staff is now removed, and the finger passed through the wound into the bladder, by which is ascertained whether the wound be sufficiently large, or whether it require enlargement, which may be easily done with a common or button-ended bistoury introduced on the left forefinger. The forceps are passed in upon the same finger, and the stone extracted according to the rules already given. After the wound has been cleansed, the patient is to be put in the same posture as after the lateral operation. Any dressing of the wound is objectionable.

Cutting into the prostate with Frère CÔME's lithotome, introduced into the groove of the staff after the membranous part is opened, as DUPUYTREN and others do, is less convenient than with the bistoury.

Geri's (*a*) mode of introducing a gorget an inch and three quarters broad at its base, three inches and a half up the *rectum* is objectionable, as straining and purging may occur during the operation, and as the *rectum* is only widened at the expense of its length, and is therefore short and folded, and the *peritonæum* approaches the neck of the bladder, so is the *peritonæum* the more liable to be wounded, and certain parts of the *rectum* must be left undivided. Vacca Berlinghieri mentions the case of a child operated on by Geri, which died twenty-four hours after, and both these accidents had happened.

These objections apply still more to the method of Sleigh (*b*), who widened the *sphincter* and the *rectum* with Weiss's *speculum ani*, found the hind edge of the prostate with the tip of the left forefinger, and then without touching the gland, cut through the wall of the *rectum* and bladder with a convex scalpel, concealed in a spring sheath, upon the groove of a staff first introduced.

2116. The *after-treatment* has the same object as in the lateral operation. The patient should take an opiate; he should use mucilaginous, diluting drinks; at first should take exceedingly little food; and, by a proper treatment, it should be endeavoured to keep off inflammation, which is more necessary in this than in the lateral operation, because it is accompanied with very little loss of blood. When suppuration comes on, usually about the seventh day, it is necessary to touch the wound with caustic at every part of the cut in the *rectum;* for this purpose, the edges of the wound are drawn apart a little, and a wooden canula, having a bit of caustic in it, is passed up, by which the cure is promoted.

2117. The advantages of cutting for the stone through the *rectum* are stated to be, *first*, that the patient is in no danger from bleeding; *second*, that the bladder is reached through the least thick parts; *third*, that the stone is most easily found, grasped, and pulled out, even when of large size, because the wound corresponds to the largest space of the *pelvis*; *fourth*, that no infiltration of urine follows.

Geri (*c*) and Scarpa (*d*), the most violent opposers of this practice, bring against it, *first*, that the wound and irritation of the *rectum* produce intermitting, irregular, febrile action after the operation; *second*, that one or both the *vasa deferentia* may be wounded, and by the pulling and stretching in the removal of the stone, are so much injured, that inflammation, swelling, wasting of the testicle, impotence from the destruction, adhesion or contraction of the mouths of the *vasa deferentia* may ensue; *third*, that the neighbouring parts are irritated by the use of the caustic; *fourth*, that by the entrance of the fæcal matter into the bladder, there is fear of its internal coat being destroyed, of dangerous irritation, and of fæco-urinary fistula; *fifth*, the recovery is more tardy. Scarpa considers this operation even more imperfect than that of Celsus.

2118. These objections are not all of equal weight. The intermittent fever is, according to Vacca's observations, in but very few cases directly connected with the wound of the *rectum.* The injury of one of the *vasa deferentia*, and the consequences based thereon, Scarpa has not supported by cases; this wound may scar or remain fistulous, and its orifice may still perform its functions; besides, the operator can even avoid this injury, and also in the lateral operation the *vas deferens* and even the *vesicula seminalis* may be wounded. The irritation of the neighbouring parts may be prevented with caustic by Vacca's method. The entrance of fæcal matter into the bladder can only happen by cutting through its base,

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(*a*) Rep. Med.-Chir. de Turin, No. 11, p. 165.

(*b*) An Essay on an improved Method of cutting for Urinary Calculi, or the Posterior Operation of Lithotomy. London, 1824. 8vo.

(*c*) Repert. Med.-Chir. de Turin, No. 11–18.

(*d*) Saggio di Osservazione sul Taglio Retto-Vesicale per l' Estrazione della Pietra della Vesica Orinaria. Pavia, 1823. fol.

and not by **Vacca**'s proceeding, as it is prevented by the valve-like protrusion of the wall of the bowel cut into below; and still more as the excrement, in consequence of the division of the *sphincter*, meets with less obstruction from the natural passage. Fistulas indeed not unfrequently remain after this operation, but they communicate only with the membranous part of the *urethra*; a little stool is passed rarely by the *urethra*, and but little urine by the *rectum*, and nothing gets into the bladder. On this point **Wenzl**'s (*a*) remark is important, that the external cut should always be made sufficiently large, by which in part, during the operation, the *sphincter* causes less obstacle, but it especially prevents the external wound contracting more quickly than the inner. The cure is indeed tedious in many cases, but in others has been observed to be as quick as in the lateral operation. As to the other objections, for instance, if the stone be very large, that the whole prostate must be cut through, the *peritonæum* may be wounded, the introduction of the instruments is not easier, and the pain in the *glans penis* after the operation is very violent; these, under corresponding circumstances, apply to the lateral operation, and in regard to the complete division of the prostate, it must not be overlooked that here, perhaps, infiltration of urine is less to be feared than in the lateral operation, because the cut being in the bottom of the bladder, the urine more readily escapes (*b*).

2119. If recto-vesical lithotomy be considered in reference to the results obtained to the present time, it is found to vary considerably with different operators. Some consider it more successful, some less successful, than the lateral operation. It has indeed its weak points, and in general must be put after the lateral operation, but it has two indisputable advantages, to wit, the slight danger there is to life, and that the bleeding is not dangerous. Therefore, in particular cases, and where, on account of the size of the stone, the cut above the *pubes* is required, and the walls of the *rectum* are healthy, it appears preferable to the high and lateral operation, as also in old persons, and those who have little blood, with a more than moderately-sized stone.

The following writers may be also referred to on this subject:—

Noethig, Ueber die verschiedenen Methoden des Blasensteinschnittes, besonders über den Steinschnitt durch den Mastdarm nach **Sanson**. Würzb., 1818.

Riberi; in Repertorio Medico-chirurgico de Turino. No. 31–33.

Vacca Berlinghieri, Memoria sopra il metodo di estrare la Pietra della Vesica orinaria per la via dell' intestino retto. Memoria terza. Pisa, 1823.

Farnese, Essame delle osservatione sul Taglio retto-vesicale dal A. **Scarpa**. Milan, 1823.

Compte-Rendu Medico-Chirurgical des Observations recueillies à l'Hôpital de la Charité de Lyon. Sec. partie, 1823.

Sanson, Compte-Rendu de la Pratique Chirurgicale de l'Hôtel Dieu de Lyon—Archives générales de Médecine, vol. vi. p. 83.

Scarpa; in Annali Universali de Medicina, vol. xxx. p. 125. 1824.

Thomson, Will., A Probatory Essay on the Extraction of Calculi from the Urinary Bladder. Edinburgh, 1825.

Koenig, Ueber einige Methoden Harnsteine aus der Blase zu ziehen; in von **Graefe** und von **Walther**'s Journal, vol. viii. p. 530.

Journal Complémentaire du Dictionnaire des Sciences Médicales; **Barbantini**, vol. xvii. p. 128. 1823.—**Dupuytren**, Memoire sur une Nouvelle Manière de pratiquer l'Opération de la Pierre, publ. par **Begin** et **Sanson**, p. 13.

(*a*) Geschichte eines Steinschnittes durch die vordere recto-vesical Methode; in N. Chiron, vol. ii. p. 181.

(*b*) Journal Complément. du Dict. des Sc. Med., vol. vi. p. 79.—Williaume, vol. x. p. 180.—Camoin, vol. xii. p. 19.—Dupuytren et Sanson, vol. xv. p. 86–87.—Pezerat, vol. xviii. p. 128.

Heinecke; in Journal von Graefe und von Walther, vol. v. p. 305.

Gustorf; in same, p. 510.

Behre; in Heidelb. Klinisch. Annalen, vol. i. p. 453.

Royer Collard, Clinique Chirurgicale de l'Hôtel Dieu; in Répert. gén. d'Anatomie et de Physiologie pathologique, etc., vol. i. p. 234.

2120. Vacca Berlinghieri's (*a*) most recent practice still remains to be noticed, which without having the disadvantages of the recto-vesical operation, unites all the advantages, and resembles the *coup de maître* proposed by Maréchal in the great apparatus (*par.* 2066.) The first cut, from twenty to twenty-two lines long, extends from the edge of the *rectum*, along the *raphe* to the *scrotum*, divides the skin, the fibres of the *m. levator ani* and *transversus perinæi*, which with the *m. accelerator urinæ*, the *urethra* and the *m. erector penis* form a sort of triangle in the *perinæum*. The left forefinger introduced into the front of the wound, seeks for the groove of the staff, which is held upright, passes the knife into it, and therewith cuts into the *urethra* to the extent of the outer wound. A knife with a blunt beak, about two lines long, is inserted into the groove of the staff, at the lower part of the wound; the staff is then raised towards the pubic arch, slightly inclined towards the operator, and then pushed about an inch deep into the bladder. Without changing the position of the staff, the handle of the knife is to be raised a little towards the *scrotum*, by which its back is jammed against the groove of the staff, and in drawing it out, the neck of the bladder, the prostate, the membranous part and the cellular tissue beneath it are cut through. If the wound be not sufficiently large, it may be easily enlarged in the usual way. In withdrawing the stone, the blades of the forceps should be directed towards the angles of the wound.

L. Balardini (*b*) has given an account of eight cases treated in the same manner.

According to Pantaleo (*c*), the oblique cut in the direction of the outer wound should be made with a double-cutting *bistouri caché*, through the upper and lower part of the prostate.

Here also must be mentioned Dupuytren's proposal, which he pursued very successfully, but has not made known publicly. He made a cut into the *raphe* opposite the staff held vertically, then with the bistoury penetrated the groove of the staff, and passed upon it into the bladder Frère Côme's *bistouri caché*, then turned the edge of the instrument upwards, for the purpose of dividing the neck of the bladder as the bistoury is withdrawn (*d*).

B.—Of Cutting for the Stone in Women.

Louis, Sur la Taille des Femmes; in Mercure de France. Décembre, 1746.

Masotti, La Litotomia delle Donne perfezionata. Firenza, 1764.

Platner, Progr. Historia literario-chirurgica Lithotomiæ Mulierum. Lips., 1770.

Cronenberg, Historia Lithotomiæ in muliere factæ. Halæ, 1811.

Behre, Dissert. de Lithotomia muliebri. Kiliæ, 1822.

Behre, Versuch einer historisch kritischen Darstellung des Steinschnittes beim Weibe. Heidelberg, 1827. 8vo.

von Kern, above cited, p. 149.

2121. The various methods and modes of proceeding in the operation

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(*a*) Della Litotomia nei due Sessi. Quarta Memoria. Pisa, 1825.

(*b*) Annali Universali di Medicina, vol. xlvi. p. 238. 1828.

(*c*) Lancet, 1833–4, vol. ii. p. 557.

(*d*) Sanson, above cited, p. 48.—Salzburg Med.-Chir. Zeitung, vol. i. p. 285. 1818.—Royer-Collard, above cited, p. 500.

of cutting for the stone in females may be most conveniently brought together under the following heads:—

First. The cut below the arch of the *pubes*, with the divisions of the *urethra* and neck of the bladder.

a. The cut made as in the lateral operation.

b. The horizontal cut on one or both sides, with or without dilating.

c. The vertical cut upwards.

d. The vertical cut downwards.

Second. The cut below the pubic arch, without division of the *urethra*.

a. The vestibular cut of CELSUS and LISFRANC.

b. VON KERN's method.

c. The vagino-vesical operation.

Third. The cut above the pubic arch.

[It may be well to notice here ASTLEY COOPER's observation, that women suffer more from stone in the bladder than men, and that "in addition to the symptoms observed in the male, as the irritability of the bladder increases, the pain during micturition is excessive, and there is agonizing suffering after the discharge of the urine from bearing down of the bladder, *uterus*, and *rectum*, with a sensation of their being forced through the lower opening of the *pelvis*. The retention of urine becomes imperfect, and the person is always wet, and smells offensively of urine. The sufferings of the patient at length render her incapable of moving from her bed." (p. 298.)

BRODIE observes, that "in women, *calculi* of a small size are expelled as they are in the male sex, without ulceration or other injury to the *urethra*, and without the patient suffering any inconvenience afterwards. *Calculi* of very considerable size occasionally escape from the female bladder; but the natural cure in these cases is effected by a less simple process." In one case he mentions "a large *calculus* was found in the *vagina*, which was extracted with the fingers, the *urethra* and *vagina* had ulcerated, and the *calculus* had passed through the ulcerated opening." (p. 350.) A similar case is mentioned by ASTLEY COOPER, "in which the stone" was placed half in the *urethra* and half in the *vagina;* the extremities of the stone were large, and connected by a narrow portion which passed through an ulcerated opening in the under part of the *urethra*." (p. 298.)]

2122. Cutting for the stone in women *by the lateral operation* is performed in the following manner:—

After the patient has been bound and properly fixed in the same position as in operating on the male, the *labia* are separated from each other, the operator passes a straight staff through the *urethra* into the bladder, holds it with his left hand in such way that the groove may be directed outwards and downwards, and its convexity pressed against the lower edge of the pubic arch, and passes on it a common bistoury, or the knife used in the lateral operation, or even a gorget with the edge directed downwards and outwards, between the *vagina* and the ascending branch of the haunch-bone, up to the closed end of the staff. In withdrawing the bistoury, its point must be sunk for the purpose of enlarging the cut.

If Frère CÔME's lithotome be used, it must be introduced closed through the *urethra* into the bladder, after setting it at a number corresponding to the size of the stone, pressed against the pubic arch, and withdrawn, whilst the blade is projected, in such direction that the *urethra* and neck of the bladder may be divided obliquely downwards and outwards, as when the bistoury is employed. The forceps are then introduced on the finger or on a gorget, and the stone drawn out according to the rules already laid down.

In this mode of operating there is danger of wounding the *vagina*, or the pudic artery; and in removing a large stone, there is fear of irritating the cellular tissue attaching the *urethra* and of palsy of the neck of the bladder, in consequence of the bruising and dragging which it suffers (*a*).

2123. In the *horizontal cut* on one (usually the left) or on both sides, the cut is made either with a narrow blunt-ended bistoury, with a common stone-knife, with a cutting gorget upon a staff, or director, of which the groove is directed towards the side; or with Frère Côme's lithotome, or with a proper single or double-cutting instrument, and its enlargement effected with the gorget, the finger, the forceps, or the dilators. In this mode of cutting, the *vagina* indeed is safe from injury, but damaging the pudic artery is more to be dreaded.

Le Cat's method with the grooved staff.—Hoin's dilating lithotome.—Franco's cutting forceps.—Louis and Flurant's double-edged *lithotome caché*.—Le Blanc's single-edged lithotome, and the like.—Compare also Behre.

[Liston employs the horizontal cut, but not to the extent here mentioned. He says:—"The best mode of extracting foreign bodies from the bladder is to widen the *urethra* gradually by means of the screw-dilator, then by the introduction of a straight blunt-pointed knife to notch the neck of the bladder *slightly* towards each *ramus* of the *pubes*, so as to divide the dense fibrous band encircling it; the dilatation is continued, and in a few minutes the finger can be admitted; the stone can then be readily grasped by a pair of forceps, and it is astonishing how large a body may be removed by these means. Incontinence of urine may follow the operation from the distension of the *sphincter* of the bladder; but in a few weeks this will generally cease. The mode of proceeding above recommended is by much to be preferred over the mere dilatation, as being less painful and more rapid in execution; and looking to the after-consequences, it is undoubtedly preferable to extensive incision of the neck of the bladder with or without wound of the *vagina*." (pp. 525, 26.)]

2124. In the *vertical cut upwards*, formerly advised by Colot (*b*), and recently by Dubois, after the patient has been properly placed, a staff is introduced into the *urethra* with its groove upwards; and whilst the operator holds it with his left hand, he presses its back against the lower wall of the *urethra*, by which its canal is expanded for the purpose of its more ready division. A narrow-pointed single-edged bistoury, with its edge a little directed to the left so as to avoid the *clitoris*, is now passed in, and whilst the two instruments form an angle, the point of which corresponds to the neck of the bladder, and the base to the *perinæum*, the canal of the *urethra* and the neck of the bladder are divided. After the knife has been withdrawn, a gorget is introduced on the groove of the staff, and upon it the forceps (*c*). Richerand (*d*) and Dupuytren employ for this operation Frère Côme's lithotome, which having been introduced through the *urethra* into the bladder with its edge above, and rather inclined to the side, is withdrawn, whilst its blade is projected.

[Brodie performed an operation which is a modification of the vertical cut upwards. He says, he "was informed it had been adopted by an eminent provincial Surgeon, and had not been followed by the usual incontinence of urine. "I introduced," says he, "a *bistouri caché* into the *urethra*, having previously fixed the screw in the handle of the instrument, so that the cutting edge could not be made to project more than to a very small extent; perhaps to about one-sixth of

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(*a*) Klein, Prakt. Ansichten u. s. w., part ii. p. 1.—Schreger, Chirurgische Versuche, vol. ii. p. 132.

(*b*) Ambr. Parei, Opera, edit. Guillemeau, lib. xvi. cap. xlvii. p. 506.

(*c*) Dupuytren, Lithotomie, 51.

(*d*) Nosographie Chir., vol. iii. p. 558. Fifth Edition.

an inch. Then drawing out the *bistouri*, with the cutting edge turned directly upwards, I endeavoured to divide the membrane of the *urethra* immediately below the *symphysis* of the *pubes*, without allowing the incision to extend into the contiguous cellular structure. The next step of the operation was to introduce Weiss's dilator, and dilate the *urethra*, so as to allow of the introduction of the finger, and afterwards of the forceps, into the bladder. As the *urethra* now offered no resistance, this dilatation was readily effected in the course of a few minutes, and thus the stone was extracted. The patient did not suffer from actual incontinence after the operation; she could not, however, retain it for so long a time as before the disease existed; I believe not longer than two hours. But I have performed the same operation in several other cases with a still more favourable result." (p. 354.)]

2125. This operation has the following advantages:—The lower part of the *urethra* has not any bone beneath it, it is very supple and yields below. After the operation, the uninjured lower wall of the *urethra* forms a groove over which the urine flows out without disturbing the cure of the wound above, the healing of which may be assisted by the pressure of a sponge introduced into the *vagina*. Further, the trunk and large branches of the pudic artery are preserved from injury, and in the event of any of its minute terminal branches bleeding, they are readily stanched by pressure against the arch of the *pubes*. Great as these advantages are, it must, however, be remembered that large stones cannot be withdrawn without considerable bruising of the neck of the bladder, and tearing the natural connexions of the *urethra*, the consequence of which is incurable incontinence of urine (*a*).

2126. The *vertical cut downwards* may be made on the groove of a male staff, held upright, and its concavity pressed against the arch of the *pubes*, with a common bistoury; or Frère Côme's lithotome may be preferred, with which the *urethra*, the neck of the bladder, and the corresponding wall of the *vagina* may be cut through downwards in their mesial line. This method corresponds to the recto-vesical operation on the male; by it a sufficiently large wound may be made without danger of bleeding, and the largest stone may be extracted with ease, as experiments on the dead, and successful results on the living, have satisfied me. That incontinence of urine is to be feared with a free cut, and that the danger of a vesico-vaginal fistula is greater than in the common mode of cutting the bladder and *vagina*, is refuted, at least by my experience, which especially determines me to consider this as the most preferable mode of operating (*b*).

Falconet (*c*) heretofore recommends this practice.

Bromfield (*d*) mentions that he saw a Surgeon introduce one blade of a pair of button-ended scissors into the *urethra* and the other into the *vagina*, and divide the under part of the *urethra*, up to the entrance of the *vagina*, to the extent of an inch at least. According to Bromfield, such a cut could never again unite, the contrary of which my observations prove; but he says, as the neck of the bladder had the major part of its *sphincter* muscle not divided, the patients in general kept their water pretty well.

2127. The cut *below the pubic symphysis*, without dividing the *urethra* and the neck of the bladder, is the method of Celsus. The stone must be pressed against the neck of the bladder in girls by the finger in the *rectum*, and in women by the finger in the *vagina*, and the stone cut on

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(*a*) Behre, p. 129.

(*b*) Chelius, Ueber den Steinschnitt beim Weibe; in Heidelb. Klinisch. Annalen, vol. vi. part i.—Sicherer; in Würtembergischen Correspondenzblatt. July, 1843. No. 22.

(*c*) An educendo calculo cæteris anteferendus apparatus lateralis? Paris, 1744.—In Halleri Disput. Chirurg., vol. iv., p. 208.

(*d*) Above cited, vol. ii. p. 279.

in the one on the under and left side, and in the other between the *urethra* and the arch of the *pubes*. The great objection to this method is self-evident; the pudic artery, the *vagina*, and even the *rectum*, are exposed to injury, on which account this operation is generally discarded (*a*).

2128. LISFRANC's *vestibular cut* is to be considered a modification of CELSUS's operation. After the patient has been placed in the usual posture and bound, two assistants draw the *labia* apart. The operator standing between the legs of the patient, introduces a common male staff through the *urethra* into the bladder with its convexity upwards. An assistant then grasps the handle of the staff, and draws the *urethra* and *vagina* downwards. The operator, after having assured himself of the position of the pubic bones, and of any variety of the pudic artery, by the introduction of his finger into the *vagina*, places the left fore and middle finger upon the points where the cut is to begin and end, and with them stretches the cellular tissue. Then holding a straight bistoury, as a pen, he makes a semi-circular cut through the external membrane, and the stretched cellular tissue of the vestibule, which is to begin on the right side at correspondent height with the orifice of the *urethra*, runs within the pubic arch at the distance of a line, and terminates on the left side at a similar height to its beginning. The cellular tissue is then divided layer by layer in the same direction till the front of the bladder is cut through, in doing which all pressure against the bladder must be avoided. The left thumb is now introduced into the *vagina*, and the left forefinger into the wound, and the wall of the bladder therewith made tense and pressed forwards. A longitudinal or transverse cut is now made into the body of the bladder with the bistoury, or if this seem to be unsafe, the cut is to be made on the groove of the staff, or a dart sound may be used, upon which the bladder is opened and the forefinger being passed into the wound, it is to be enlarged either longitudinally or transversely with the knife (*b*).

2129. This proceeding of LISFRANC's is objectionable on very many grounds. The cut is made into the bladder where there is least space, consequently the extraction of even a moderately large stone is difficult, and accompanied with bruising; the pudic artery, the position of which cannot be well determined by the examination before the operation, may be wounded; the front of the bladder is easily separated from its cellular connexions; the vascular net at the seat of the cut, often much developed in stone-patients, may be injured, and the wound in the bladder may slip from the external wound, in consequence of which there will be infiltration. It is difficult to understand how in using the dart sound, at least with its usual curve, the dart can be protruded some lines above the neck of the bladder (*c*).

PIERS USO WALTER (*d*) has practised LISFRANC's vestibular cut successfully in a woman of forty-five.

2130. VON KERN's practice, which he has successfully followed, is the following. After the patient has been properly placed and the staff introduced into the bladder, an assistant standing on the right side, holds the staff with his left hand and sinks it a little towards the patient's right

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(*a*) MERY, Observations sur la Manière de tailler les Deux Sexes pour l'Extraction de la Pierre, pratiquée par Frère JACQUES. Paris, 1700.

(*b*) Mémoire sur une Nouvelle Méthode de pratiquer l'Opération de la Taille chez la Femme; in Revue Médicale, vol. x. p. 1. 1823.—MERESSE, Dissert. sur la Lithotomie chez la Femme. Strasb., 1823.

(*c*) BAUDRY, L., Dissert. du meilleur Procédé à employer pour l'Opération de la Taille chez la Femme. Strasb., 1823.

(*d*). VON GRAEFE und VON WALTER's Journal, vol. xviii. p. 285.

groin, and places the fore and middle fingers of the right hand near the orifice of the *urethra* at its under part, which he draws down tightly, at the same time separating the *labia* with the thumb and other fingers. The operator then finds the hinder extremity of the *urethra* with the left thumb-nail near the neck of the bladder, places the nail upon the right edge of the staff, penetrates the stretched *urethra* with the lithotome, and enlarges the cut by carrying the scalpel forwards in the groove of the staff, and at the same time presses it on with the thumb until the opening is of sufficient size (*a*).

2131. The *vagino-vesical cut* has the closest resemblance to the recto-vesical; it is performed most safely in the following manner. After placing the patient in the position for the lateral operation, a staff is passed by the *urethra* into the bladder, and a wooden gorget with its concavity upwards is introduced into the *vagina*. Both instruments are brought together so as to form a larger or smaller angle, in proportion to the cut to be made. The gorget is to be well pressed downwards, so that the front wall of the *vagina* can be got at. A straight, pointed bistoury is to be held like a pen in the right hand, its point passed into the groove of the staff behind the canal of the *urethra*, and then by thrusting it forwards, an opening is made corresponding to the size of the stone. Its extraction and after-treatment are conducted according to the ordinary rules.

2132. The advantages of this mode of operating are great. There is no bleeding, no incontinence of urine, and the largest stone may be in this way removed. The production of a vesico-vaginal fistula, which may be objected to this operation, cannot, at least from present experience, be considered as the usual consequence. If this operation be restricted only to the extreme cases of very large stones, it has however there undoubted preference over cutting into the bladder above the *pubes*, as the patient's life is never endangered, and at the utmost there is the inconvenience of a fistula. The objection made by some, that the scar produced by this operation would cause difficulty in child-birth, is contrary to experience.

Upon this subject the following works may also be consulted :—

FABRICIUS HILDANUS, De Lithotomiâ, p. 149.

RUYSCH, Observationes Anatomico-pathologicæ, Obs. i.

MERY, above cited, p. 28.

LOUIS, above cited.

BUSSIÈRE; in Philosophical Transactions, vol. xxi. p. 100. 1699.

LISTER, Iter Parisianum, 1697.

GOOCH, Cases and Practical Remarks in Surgery, vol. ii. p. 182. London, 1758. 8vo.

MICHAELIS, Etwas uber den Blasenschnitt, p. 57. Marb., 1813.

DUPUYTREN, above cited, p. 55.

FLAUBER et CLEMONT; in SANSON, above cited, p. 23.

VACCA BERLINGHIERI, above cited, p. 110.

——————————, Del Taglio vagino-vesicale, Pisa, 1825.

[In all the previously described operations, incontinence of urine is a very troublesome consequence and often incurable. ASTLEY COOPER, indeed, says:—"In all cases of this operation which I have performed or witnessed, the urine has not been afterwards retained; but I would not deny that a patient might recover the retentive power. As the loss of retention is a greater evil than I can describe, producing excoriation and a very offensive state, I shall in any future operation of lithotomy, try what may be effected by employing a suture to bring the divided parts together." (p. 303.) BRODIE's operation (*par.* 2124) seems to have been partially successful; but LISTON (*par.* 2123) seems

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(*a*) Above cited, p. 154.

to think that his mode causes only a temporary incontinence. Most Surgeons however are, I believe, sadly perplexed with this tiresome result, and the patient necessarily still more so. Very recently I have seen a woman, who was cut with the gorget about twenty years ago; she cannot retain her water at all, but it is constantly dribbling away, and she is in a very pitiable condition. To avoid this untoward result, Hey (*a*) made use of a cylindrical linen tent two inches long and one broad, which he passed into the *vagina*, for the purpose of bringing the edges of the wound together without obstructing the *urethra*, and the plan succeeded. Brodie tried the same method, but unsuccessfully; though perhaps it may have depended on the child's irritability. I am not aware that Astley Cooper's suggestion of sutures has yet been tried.

The large size of stones which have been passed spontaneously, as related by Heister (*b*), Middleton (*c*), Colot (*d*), Molineux (*e*), and Yelloly (*f*), as well as the earpicker-case mentioned by Thomas (*g*), which was removed by dilating the *urethra* with sponge tent, led to the proposal of dilating the *urethra* either with sponge, or with an instrument corresponding in form to a *speculum ani*. These methods have, however, been generally followed by incontinence, if the dilatation have been made to any great extent. Brodie says, indeed, that "none" of the cases to which he refers "suffered from actual incontinence of urine; but one of them, in whom the *calculus* was of large size, could not retain more than two or three ounces of urine in the bladder afterwards." And hence he concludes, that "the method of dilatation is not to be recommended, except in cases of moderate size." (pp. 351, 52.) I think, if I should be called on to operate for stone in the female, I should be disposed to perform the lateral cut with the gorget or knife, it would not matter much which, and adopt the method recommended by Hey.—J. F. S.]

2133. *Opening the bladder above the pubic symphysis* has been particularly recommended in women, because, in drawing out the stone by the outlet of the *pelvis*, injury of the *vagina* or of the pudic artery is feared; large stones cannot at all be extracted, and incurable incontinence of urine remains as the frequent consequence of this operation. The proceeding is conducted exactly as in the male, and the escape of the urine from the wound above can be more readily prevented, by the introduction of a catheter through the *urethra*.

COMPARISON OF LITHOTOMY AND LITHOTRITY.

2134. In considering the advantages and disadvantages of lithotrity, as compared with those of lithotomy, it must be first remarked, that many of the objections properly made to its earlier mode of performance, as the difficulty of introducing the instruments, its tedious operation, especially when the stone is hard and the like, have lost much of their importance, or are entirely removed, by the great degree of perfection to which lithotrity has of late attained. The time has not, however, yet fully arrived, nor are the results yet in such condition, that a positive opinion can be given on this point. The hitherto-furnished statistics of the results of lithotomy and lithotrity afford no decisive clue, because stone-patients must, in reference to this point, be divided into three classes; *first*, those which are favourable, for the effectual crushing; *second*, those in which the crushing may be attempted, but cannot be completed; *third*, those in which, on account of various circumstances, lithotrity must from the first be considered inapplicable. It is therefore clear that if only simple and slight cases fall within the compass of lithotrity, and that to lithotomy the other two unfavourable classes belong,

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(*a*) Practical Observations on Surgery, p. 560. Edition of 1810.

(*b*) Chirurgie. Nürnberg, 1719.—Translated as, A General System of Surgery. London, 1757. Sixth Edition.

(*c*) A Short Essay on Lithotomy above the Pubes. London, 1727. 4to.

(*d*) Traité de l'Opération de la Taille. Paris, 1727. 8vo.

(*e*) Philosophical Transactions, vol. xx. p. 11. 1698.

(*f*) Med.-Chir. Trans., vol. vi. p. 577.

(*g*) Ibid., vol. i. p. 123.

therefrom the results of both must necessarily be judged. In the collation of such results, in great number and for a length of time, the progressive improvements in the operations of lithotomy and lithotrity must be also well considered. Only in reference to these different circumstances can it be comprehended, how the results which have been collected from a great number of cases of lithotomy, have been more favourable than those of lithotrity (perforation); and how the results of percussion, (Heurteloup,) though by far more favourable than those exhibited by the earlier ones of perforation, and of cutting, have nevertheless been surpassed by the results which individual operators have obtained with the knife.

2135. If the possible evils which may occur in and after lithotomy and lithotrity be compared, they are found to have a certain degree of equality as to their number and danger; only that in lithotomy, the wound especially gives rise to symptoms which in lithotrity are absent, whilst the latter occasions considerable irritation of the bladder, and dangerous symptoms resulting therefrom.

The possible evils resulting from lithotomy are bleeding, wound of the *rectum*, of the seminal vesicles and their excretory ducts, and of the deep pelvic *aponeurosis;* subsequently, bleeding, infiltration of urine, extravasation into the *scrotum*, inflammation of the cellular tissue of the pelvic cavity, inflammation of the *peritonæum*, of the bladder, of the prostate and of the veins, urinary fistula, impotence, and incontinence of urine.

The possible evils from lithotrity are violent pain and nervous symptoms, especially in very sensitive persons, inflammation of the urinary passages, of the prostate, and of the testicle; in rare cases, tearing of the mucous membrane of the bladder, perforation of the bladder, inflammation of the veins; further, retention of urine, infiltration of urine, urinary fistula, breaking of the instruments in the bladder (1), and recurrence of stone (2).

[(1) In the event of lithotritic instruments being broken or bent in the bladder, so that they could not otherwise be removed, Liston says:—"I had determined, should I meet with any case of the kind, to pull forward the instrument as far as possible, so as to bring the sliding blade (of the *percuteur*) into close contact with the anterior walls of the bladder, and these with the anterior aspect of the *symphysis*, then to push down the *penis* upon its stalk, and protect the *glans* with a piece of split card or strong leather; the instrument was then to be seized with a hand-vice, and cut through as low as possible, by the use of good files; this can be done within two inches and a half of the curve. There would then be no difficulty in pushing the blades containing the stone back into the bladder and commencement of the *urethra*, and cutting them out together." (p. 502.)

(2) "It may be said," observes Brodie, "that hæmorrhage is one of the inconveniences attendant on the operation of lithotrity. It may arise from the forcible introduction of the lithotrity-forceps through the neck of the bladder, where the prostate gland is somewhat enlarged, or from the dilatation of the prostate and *urethra* in the act of withdrawing the forceps, when the blades are charged with a considerable accumulation of the crushed *calculus* matter. The loss of blood, for the most part, does not amount to more than a few drops; but in some instances, I have known it to be sufficient to discolour the urine for one or two days afterwards. * * * The occurrence of rigors is another ill consequence of lithotrity, in some instances. I have already mentioned, that a rigor is usually produced by the stretching of the *urethra*, at the time of the forceps being withdrawn from the bladder, and that, in most instances, it may be prevented by the exhibition of a dose of opium immediately after the operation. This symptom, however, may arise from other causes; as, for example, from a fragment of *calculus* finding its way into the *urethra*, which is too large to be expelled by the pressure of the stream of urine. And it sometimes happens, that the effect of a dose

of opium is, not to prevent the rigor altogether, but to cause it to be deferred till the following day. The liability to rigors, however, where due precautions are used, is seldom such as to interfere in any great degree with the process necessary for the patient's cure and his ultimate recovery."—(pp. 370, 71.)]

2136. If these various circumstances in lithotomy and lithotrity be compared in regard to their cause, to wit, the wound in lithotomy, and the injury of the bladder in lithotrity, it must be presumed that pain and nervous symptoms may be equally present in both, but their frequent repetition in lithotrity is of importance; that bleeding, wound of the *rectum*, injury to the *peritonæum*, which are very much to be dreaded in lithotomy, cannot happen in the modern practice of lithotrity; that infiltration of urine, so frequently fatal after lithotomy, is almost impossible in lithotrity; that *phlebitis* and *peritonitis* are observed not unfrequently after lithotomy, but very rarely after lithotrity, which also applies in like manner to the continuance of fistula; that, on the other hand, inflammation of the bladder, inflammation and abscess of the prostate are more common after lithotrity than after lithotomy. Bruising or tearing of the mucous membrane of the bladder, as also breaking of the instruments in the bladder, is at the present time scarcely possible, with the improved instruments.

Many of the evils mentioned are principally dependent on the operator; this remark, however, applies as well to lithotomy as lithotrity.

2137. Further, if lithotrity be considered in reference to the condition of the urinary organs, the age, sex, and constitution of the patient, and the nature of the stone, it follows, that a diseased change and swelling of the prostate, purulent catarrh, great sensibility, and contraction of the bladder, render lithotrity quite impossible, or considerably increase its danger.

Although lithotrity was formerly considered inapplicable to children, and numerous experiments by CIVIALE, AMUSSAT, LEROY, and others, have proved its practicability in little children; yet, however, the result of lithotomy at this age is so favourable, and the employment of lithotrity so difficult, that lithotomy should undoubtedly be preferred. In advanced age, on the contrary, the results of lithotomy are far more unfavourable than those of lithotrity. In females, the less difficulty in the introduction of instruments (*par.* 20–57) is compensated by the difficulty of keeping the bladder distended; but lithotrity, although lithotomy in woman is much more rarely fatal than in man, has this great advantage, that no incontinence of urine remains after it, an infirmity, the importance of which in women cannot be too seriously thought of. It must finally be remembered, that for very stout persons, who are always the most unfavourable subjects for lithotomy, lithotrity is by far less dangerous.

In reference to the nature of the stone, it must also be considered, that with the improved new instruments, even large stones may be broken to pieces, and that no stone, from its hardness, can easily withstand their effect; but the frequent repetition of the operation, which in such cases is necessary, causes danger, partly from the frequent irritation of the urinary organs; partly, and especially, from the repeated febrile excitement, and the inflammation of other organs thereon dependent. The same also applies to stones in large number. Such stones as are of moderate size and round or oval form, are best for crushing; flat stones are difficult to grasp and break up.

2138. If now, after the consideration, founded on experience, of the advantages and disadvantages of lithotomy and lithotrity, the particular cases in which the one or other practice is specially indicated, be reviewed, it follows that lithotrity appears preferable, *first*, in small stones or those of no great size; *second*, when there are two, or several little stones; *third*, in stones of moderate size, and when they can be easily broken, and if in all these cases the bladder be healthy, or only in a trivial degree affected. These indications are more important, when such cases occur in old persons, in females, or in very stout people. On the other hand, lithotomy is decidedly to be preferred; *first*, in childhood; *second*, with large and hard, and especially mulberry stones; *third*, when there are several large stones; *fourth*, when large stones entirely fill, or are completely locked in by a contracted and unextensible bladder; *fifth*, in diseased prostate, or great affection of the bladder; *sixth*, in very great sensibility of the bladder, so that the patient can bear neither its distension, nor the motion of the instruments; *seventh*, with stones, of which the *nucleus*, as, for example, when it is a bullet or the like, cannot be destroyed by the lithotriptor. It is also not to be overlooked, that in the general employment of lithotrity, the patient should be subjected to it early, by which its results are more certain, and its use will become more easy and general. On the other hand, however, it must not be unnoticed, that under directly the same circumstances, which are favourable for crushing, does cutting for the stone, if performed with ability, lose much of its danger.

Strictures of the *urethra* are only temporary contraindications for lithotrity, and equally applying to lithotomy, they must be first got rid of. Palsy of the bladder neither contraindicates lithotrity nor renders its performance difficult. Should the fragments of the stone indeed be discharged more slowly or with difficulty, this may be easily overcome by injections; and experience has shown that the palsy of the bladder has been relieved, and even removed, by the effect of the lithotriptic operation, which, however, has also been several times noticed after lithotomy.

["Since commencing the practice of lithotrity, I have found," says KEY, "that more than half the number of adults who have come under my care have been fit subjects for the operation; and that in the majority of persons afflicted with *calculus*, it has decided advantages over lithotomy. One among the principal advantages which lithotrity has conferred on Surgery is the early application which patients are induced to make for the relief of their disorder. Formerly * * * the disease was associated in their minds with a most painful and dangerous operation, that must be had recourse to, as a last remedy, when palliative measures failed to afford relief to their sufferings. The dangers and sufferings of lithotomy, magnified as they were by the patient's fears, often deterred him from applying for medical assistance when the pains of stone first came upon him, by the dread of having his worst fears confirmed. Even if the presence of a stone in his bladder were ascertained, it was, in too many instances, allowed to remain undisturbed, in the vain expectation that it might not increase in size, and that the severity of pain might continue to be mitigated by the medicines that so often had been found to assuage his pangs. The operation was thus procrastinated until the stone acquired a large size, often until the bladder had become diseased, and the patient's health undermined by protracted sufferings. * * * Nor has lithotrity been without its influence on the Surgeon. Formerly, when a patient first consulted him for symptoms of *dysuria*, followed by pain, he was content to palliate the malady by sedative and alkaline medicines, regardless whether they were caused by prostatic affection, stone, or any other local disturbance. The use of the sound was deferred: that could be used at any time: and, usually, it was first introduced into the bladder when the patient's sufferings had become severe and protracted. * * * The operation of sounding was also conducted in a slovenly manner. If the stone were not discovered when small, it would be when large, and no advantage was gained by operating in the early stage. Now, the Surgeon examines the bladder with great care, knowing the importance of discovering the *calculus* at the earliest period, he no longer leaves its existence a matter of doubt, but proceeds at once to examine the bladder and determines its presence; or by a skilful searching of every part of the *viscus*, ascertains that a stone does not exist. * * * The early symptoms of the disease are thus watched with more jealousy on the part of the Surgeon, and are not so scrupulously concealed by the patient. The advantages of an early knowledge of the existence of a stone, and of prompt measures for its removal, are known to both. The result of this is, that patients apply for advice when the stone is small, the bladder uninjured by its presence, and the kidneys free from disease. In three out of four persons who apply for advice, for symptoms of *calculus*, the size of the stone and the conditions of the *viscus* render lithotrity an easy and safe operation Within the last three or four years, I have marked the very early application that patients make for advice, and the small size of the stone when first discovered, compared with those of former years. In private practice, I have not extracted, by either operation, a *calculus* larger than a good-sized mulberry, except in three cases, in one of which the stone was of unusually rapid formation.'' (p. 13-15).

"The size of the *calculus*," observes KEY, "forms of itself no objection to lithotrity. A large stone presents, however, several considerations for the Surgeon to weigh before he undertakes the operation. As the stone cannot be entirely crushed at one sitting, a patient with an irritable or unsound bladder, becomes involved in most serious danger by the operation being hastily adopted. A large stone broken up into many irregular fragments, all crowded by the contractions of the bladder against the irritable and inflamed *cervix*, causes excessive efforts to void the urine, and even inflammation of the mucous surface. Under such circumstances, the repetition of the operation becomes impossible, or highly dangerous; and the patient has to struggle through the stages of inflammation, with a bladder irritated by the lesser fragments. But if the bladder be free from disease, and not very irritable, it will bear the number of sittings required to break up a large stone, without much suffering to the patient, and with very little danger. The success of lithotrity, like that of most surgical operations, mainly depends on its subject. If the constitution be good, and the power of endurance great, difficulties of most unpromising nature may be overcome. We should therefore pay more regard to the general condition of the patient, and of his bladder, than to the size of the stones; and inquire minutely into the several circumstances likely to have an influence on the result of the operation. * * * I know of no limits to the size of a *calculus* removable by lithotrity but the power of the lithotrite. If a powerful instrument can be brought to embrace it, and the organ be healthy, the operation may, as far as my experience goes, be attempted with propriety.

"The different ages of patients to be submitted to the lithotrite or the knife, are remarkably contrasted with one another. Whilst to youth and advanced age the latter is more suitable, the former is found generally better adapted to the middle period, between puberty and the decline of life. We have seen, in speaking of lithotomy, that persons whose sexual organs are completely developed, are more liable to the accidents attending the use of the knife than children, whose organs are not yet evolved; or than the aged, whose irritability is on the wane. The full-grown healthy adult, on the contrary, presents all the conditions most favourable for crushing the *calculus*. The canal is sufficiently large to admit an instrument efficient from its size; the prostate gland is usually healthy, and free from the enlargement of age; thus rendering the neck of the bladder, a part so important in the operation, little exposed to the dangers of inflammation. When there is a normal prostate gland, the operator may manipulate his instrument without risk of bruising, or otherwise injuring this most sensitive of all the parts concerned in the operation. The *urethra* of such patients being more free, the fragments are expelled with less difficulty, and cause less pain in their expulsion, which is also materially assisted by a sound and vigorous bladder. At this age also, inflammation, should it supervene, is more easily controlled than in the aged subject, who cannot well bear depletion. The warm bath and free venesection, speedily arrest the inflammation of the mucous membrane of the bladder; but the old are soon depressed by the diseased action, as well as by the measures required for its suppression. Inflammation, however, is less liable to occur in such healthy subjects, where the parts are not mechanically injured by the operation, and when the patient has been prepared by dietetic and other prudential measures. The aged subject, however, is not less adapted to the operation than the younger adults, if he be free from the common accidents of age, as an enlarged prostate, accompanied with an irritable state of the bladder. If the parts in the aged are sound, the operation is especially successful in them; as there is less irritability in the organs of generation, and less excitability of the general system. The *urethra* also is usually larger, and if the neck of the bladder be free, it allows fragments of extraordinary size to pass. * * * In the old subject, however, difficulties often present themselves, in consequence of the change which the parts about the neck of the bladder undergo, and the unsound condition of the bladder itself consequent on these changes. The operation in such persons is rendered dangerous by the inflammatory disposition of the organ, and by the difficulty with which the fragments make their way through the prostatic portion of the canal.

"The state of the bladder is, perhaps, of all the circumstances that the lithotritist has to consider, the most important; and one on which the propriety of performing the operation will mainly hinge. Three conditions of this organ are necessary, and these must be ascertained by preliminary observations and trials, before the operation is determined on: *first*, it must be capable of holding a sufficient quantity of water to facilitate the working of the percussor; *second*, it must be free from that extreme irritability that often attends the latter stages of calculous disorders; and, *third*, not prone to inflammation from slight excitement. In healthy persons, the bladder, even under the irritation of a stone, will allow several ounces of water to be injected into its cavity, without sustaining more than a slight inclination to eject it. Its retentive powers are not impaired in the early stages of the disorder; patients will go for many hours without any desire to empty the bladder, the only early symptom being a smarting, when the bladder contracts on the *calculus*. It is therefore rare to meet with any difficulty in injecting water sufficient for the purpose of giving space for the operation, amongst those who apply for advice soon after the symptoms have begun to declare themselves. Even when, from the long-continued presence of the stone, the bladder becomes morbidly affected, and able to contain but three or four ounces of urine without an irresistible desire to expel it, much may be done by treatment to assuage the irritation of the mucous membrane, and tranquillize the muscular excitability. When the stone has been long resident in the bladder, and has produced a change in the mucous membrane, and a copious discharge of phosphatic *mucus*, signs of extreme irritability come on, and almost seem to forbid any expectation of lithotrity being practicable. The desire to void urine is renewed every two hours or oftener; the urine not only deposits a large quantity of dark-coloured *mucus* but is cloudy, and loaded with small flakes of adhesive matter, the result of inflammation of the mucous lining; the pain in expelling the last few drops of *mucus* is intense. Such continued suffering affects the general health; and would seem, I say, to forbid the operation altogether. Frequently, however, will these formidable symptoms yield to a system of diet and medicine, and the patient by degrees be unexpectedly brought into a condition to bear the operation." (p. 23–36.)

"Those who have irritable bladders usually experience some form of irritation after moderate distension with water and examination with the catheter. It generally assumes the form of rigor occurring once or more in the twenty-four hours after the examination has been made, and followed by severe *pyrexia*, that lasts for several days. The rigor of itself indicates the degree of irritation produced by the sound; and if not followed by the hot stage of fever, it indicates nothing more; but the presence of *pyrexia* is evidence of inflammation taking place, and such a state is most unfavourable to lithotrity. A distinction, therefore, is to be drawn between these two states; the occurrence of a rigor need not deter the Surgeon from commencing the operation—it often attends the first examination, and may never recur; but the indication of inflammation, drawn from a continued state of *pyrexia*, should at once induce him to defer the operation, until by withdrawing all *stimuli*, he has brought the bladder into a tranquil state. The disposition to inflammation is often kept up by improper food, especially drink; and is indicated by a plethoric condition of the system, and a flushed countenance. Such a condition may be overcome; and is unlike that state of bladder which is the effect of commencing disorganization, and often associated with diseased kidneys. (p. 37.)

"One principal source of irritability of the bladder is a morbid condition of the *cervix*, or of the prostate gland. The structure about the neck of the bladder, above all others deserves the especial attention of the lithotritist; as it is here that he will ever meet with the most difficulties, and will also find the chief source of danger. The extreme susceptibility of this part of the bladder is not unfrequently evinced in severe rigor and inflammation following the introduction of a sound in patients who complain of *dysuria* connected with an enlarged prostate. These persons, often highly disposed to inflammation, have a severe attack brought on by the casual introduction of an instrument for the purpose of ascertaining the cause of their ailments. When the morbid condition of the gland is combined with *calculus*, the risk of inflammation, and the danger of its consequences, become greatly increased; and the hasty performance of lithotrity in persons not prepared for the operation, has been known to induce a fatal *cystitis*." (pp. 38, 9.)

"It would be a great error," says Brodie (*a*), "to represent lithotrity as preferable on

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(*a*) Above cited.

all occasions to lithotomy ; but it is so in a great many instances. I shall endeavour to explain by what signs you may distinguish from each other the cases to which it is applicable, and those to which it is not. In boys under the age of puberty, lithotomy is so simple and so generally successful, that we ought to hesitate before we abandon it for any other kind of operation. There is also a manifest objection to lithotrity in these cases, on account of the small size of the *urethra*, which is such that it would not admit of the introduction of instruments of sufficient strength to crush a *calculus* of more than moderate dimensions. In the female sex the extraction of a *calculus* from the bladder by the ordinary methods is attended with little danger ; while the operation of crushing is rendered difficult in consequence of the short and wide *urethra*, allowing the water which has been injected into the bladder to escape by the side of the lithotrity-forceps before the operation is completed. In cases in which the *calculus* has attained a very large size, it is often difficult to seize it with the lithotrity-forceps ; the operation of crushing requires to be repeated a great number of times, so that many weeks may elapse before the cure is accomplished ; a large quantity of fragments is left in the bladder, of which the necessary consequence is a great liability to inflammation of the mucous membrane ; and of course the inconvenience produced by the passage of the fragments along the *urethra* is multiplied, as compared with what happens when the *calculus* is smaller. These circumstances form a sufficient objection to the operation of lithotrity in these cases. It is true that they are unfavourable cases for lithotomy also ; but I have little doubt that the latter method is the safer of the two. It admits of a question, whether in such cases the two modes of operating may not be advantageously combined, the *calculus* being crushed into three or four pieces first, and extracted by the usual incision afterwards. The operation of lithotrity is not well adapted to those cases of enlargement of the prostate gland, in which the patient is unable to empty the bladder by his own efforts, unless the *calculus* be of small size, so that there may be no difficulty in crushing the minute fragments into which it has been crushed out of the bladder through a large catheter. There is also another objection to the operation in some cases of enlargement of the prostate, namely, that the tumour which projects from it into the cavity of the bladder, makes it difficult to elevate the handle of the forceps sufficiently to seize the stone easily in the usual manner.

" I have described the dangers which attend on lithotomy in those cases in which a *calculus* of the bladder is complicated with disease of the kidney. One of the principal of these is connected with the loss of blood, which that operation must always occasion to some extent, and not unfrequently to a great extent, in spite of the best exertions of the Surgeon to prevent it. I have no doubt that in such cases, the operation of crushing is the safest method of proceeding ; but a small shock to the system will sometimes destroy the life of a patient who labours under renal disease, and it will be often more prudent to trust to the means which we possess of palliating his sufferings, than to run the risk of shortening his life in the endeavour to obtain a cure. * * * With the exception of such cases as those which have been enumerated, there are few to which this method of treatment (Lithotrity) may not be advantageously applied. It may be said that the exceptions are numerous ; but they are the result chiefly of delay. If a patient seeks the assistance of a competent Surgeon within six or even twelve months after a *calculus* has descended from the kidney into the bladder, the urine having remained acid, it will rarely happen that he may not obtain a cure by a single operation, and with so small an amount of danger, that it need scarcely enter into his calculations. As time advances, the facility with which he can be relieved diminishes, and after the lapse of two or three years, especially if the urine has become alkaline, it is probable that the *calculus* will have attained such a size as to render the old operation (Lithotomy) preferable, and that the access of disease in the bladder or kidneys may render any operation hazardous. It would be absurd to say, and it would be unreasonable of human kind to expect, that an operation which has for its object to relieve them of a disease so terrible as that of a stone in the bladder, can be always free from inconvenience, and difficulty, and danger. Nevertheless, from what experience I have had, I am satisfied that the operation of lithotrity, if had recourse to only in proper cases, is not only much more successful than that of lithotomy, but that it is liable to fewer objections than almost any other of the principal operations of Surgery." (p. 375–79).

" The operation of lithotrity," says LISTON (*a*), " is applicable to patients above the age of puberty, when the symptoms have not endured very long ; when the foreign body is ascertained to measure six or seven lines, or even more perhaps, say as large as a chestnut ; when the bladder and *urethra* are in a tolerably healthy and normal condition,— as indicated by the power to retain the urine comfortably for several hours, and to pass

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(*a*) Practical Surgery.

it in a tolerably free stream; and when the *viscus* admits of injection and a careful exploration. That the stone may be seized readily, and acted upon without danger to the lining membrane, the bladder should contain at least five or six ounces of fluid." (pp. 500, 501.)

"When the stone is much larger than above indicated, and when there is reason to suspect that the bladder, in consequence of the endurance of the irritation, has become contracted, fasciculated and irregular on the surface, presenting the rudiments of pouches, it will be absolutely impossible to make sure of removing all the *detritus*. *Nuclei* must be left, and very shortly the patient will have five or six stones perhaps substituted for the original one formed upon these. The suffering and danger, moreover, endured by the patient at each sitting, when these are often repeated, in an unsound bladder, for removal of the fragments of a large concretion, are much greater than those resulting from a speedy and well-conducted safe operation for its removal entire and at once. When lithotomy is well performed, the excited state of the bladder is relieved by the removal of all source of irritation, by the *viscus* being put at rest, and its functions suspended, and by the loss of blood from the neighbouring vessels. In lithotrity, on the other hand, when the stone is large, considerable fragments are often left, and the irritation is thus greatly increased. The pain experienced in passing fragments, is often extreme, and not unattended with danger; for difficulty is often experienced in dislodging portions from the *urethra*. Then retention follows, perhaps, with inflammation of the bladder. * * * Blood too is often lodged in the bladder and removed with difficulty. The excited action which follows is perhaps at first slow and weak, but it soon becomes lighted up by the continued irritation resulting from the frequent contraction of the *viscus*, and contact with the angular pieces of the concretion. Unless a very correct judgment is exercised in determining upon the practice in particular cases, and great gentleness observed in the manipulations, fatal results must very often follow.

"The operation of lithotomy must yet continue to be performed on children, and on those of mature age who are so ill informed or foolish as to permit the stone to attain an inordinate bulk. * * * Of late years, in point of fact, I have scarcely been obliged to have recourse to lithotomy at all in private practice. At the hospital, patients yet present themselves with large stones and bad bladders. Then lithotomy is both a less painful and much more safe operation, as already propounded. During the period of the last six years, twenty-four patients have been cut, and all have recovered without accident; these patients have been of all ages, from two to eighty years, and some of them not over favourable subjects. So that, after all, there is not much to find fault with as regards this 'cruel and bloody operation,' when carefully set about." (p. 503–505.)

I do not propose to offer any opinion of my own as to the preference which should be awarded to lithotrity, or lithotomy, as I have had little practical experience in regard to the former, and am not therefore qualified to give one. But I may be permitted to say that the results of the practice of lithotomy, both with gorget and knife, and by various operators on patients of all ages and under various circumstances, during the course of a long series of years at our Hospital, have been so favourable, as to afford little cause for making it give place to lithotrity. I think it is proved that lithotomy, when properly conducted, is not the dangerous operation it is too commonly held to be; and it is no trifling advantage it possesses, that the patient is relieved at once, with a few minutes' suffering, sharp indeed it must be acknowledged to be, instead of being subjected to several operations, which, the more frequent in their repetition, become, as generally admitted, greater in severity, and occasionally leave the necessity for resorting to the cure by lithotomy. I may also here add the testimony of some patients who have undergone both operations, that the suffering during lithotomy was less than in lithotrity, and that knowing both, they would, if needful, prefer undergoing the former. It is well, however, that we have the opportunity of employing lithotrity in cases where patients are too fearful to submit to the knife; but I am by no means sure that under all circumstances, lithotomy is not at least as free from danger as lithotrity, and certainly more speedy as regards the cure.—J. F. S.]

Upon the relations of lithotrity to lithotomy, the following writers may also be consulted:—

BLANDIN.

VELPEAU in DOUBOVITZKI.

WATTMANN.

HECKER.

LONGHI, A., Sulla Cistotomia e Litotrizia. Pavia, 1839.

KING, THOMAS, M.D., Lithotrity and Lithotomy compared. London, 1832. 8vo.

V.—OF STONE IN THE URETHRA.

(*Calculus Urethralis*, Lat.; *Steine in der Harnröhre*, Germ.; *Calcul dans le Canal de l'Urètre*, Fr.)

2139. Stones which enter the canal of the *urethra*, as well as foreign bodies which have been introduced from without, may be fixed at different parts, may more or less hinder, or entirely prevent (1), the flow of urine, and cause inflammation of the *urethra* and of the whole *penis*, ulceration, and gangrene of the *urethra*, urinary infiltrations, fistulas, and the like. If the stone or foreign body be angular or pointed, the earlier will these symptoms be produced (2).

[(1) A stone may sometimes exist for some time in the *urethra*, and prevent the flow of urine by the stream forcing it tightly into the front of that canal, which is too narrow to permit its escape. An instance of this kind occurred to Travers in 1829, in a man of sixty years, under his care in St. Thomas's Hospital; he had been in the habit of passing small stones from childhood, during which he had been cut by the elder Cline for stone in the bladder, and, when fifteen years old, a stone blocking up the *urethra*, immediately in front of the *scrotum*, had been cut upon and removed, but left a fistulous aperture. When he came under Travers's care, he had a stone about four inches down the *urethra*, and this, when desirous of making water, he pushed back towards the fistulous opening, so that there was then room for its passage. At night his urine constantly dribbled away. This stone was removed by cutting through the fistula into the *urethra*, and lifting it out with a scoop. The aperture, however, did not perfectly heal (*a*).

A good example of retention and consequent mortification from the complete blocking up of the *urethra* by a stone, is Everard Home's case in the College Collection (*b*), of two stones from a man of sixty years old:—"The larger *calculus* was situated in the membranous part of the *urethra*, the smaller about three inches from the external orifice, the *urethra* being dilated into a cyst at each of these parts. The patient supposed himself to have laboured under strictures of the *urethra* for ten years! at last there was complete retention of urine; the urine became effused behind the smaller *calculus*, and mortification of the skin of the *penis* and *scrotum* took place to considerable extent, and the man died." (p. 121.)

(2) A curious instance is recorded by Liston (*c*), of a person who, "when a boy, had pushed a small brass curtain-ring over the *penis* till stopped by the *scrotum*, in order to prevent the urine passing off during the night. The swelling that ensued prevented its removal; he kept the occurrence secret; the tumefaction gradually abated, and the ring disappeared. But the hardened mass which remained increased in size; and latterly the functions of the parts, which had previously been very well performed, began to be disturbed. The foreign body was cut upon and removed," by Liston, "when the man was approaching fifty years of age." On making a section of it, the greater part of the ring was found forming the *nucleus*. The continuity of the erectile tissue, which had been cut through gradually by the foreign body, was perfectly reestablished." (p. 520.)]

2140. If the stone lodge in the neck of the bladder, it will, if small, produce only the common symptoms of stone in the bladder, but if it be large, it will cause more or less complete retention, and if angular and not completely enclosed by the neck of the bladder, incontinence of urine. The patient usually suffers urgent pain, a sensation of weight and pressure in the *perinæum* and *rectum*, and a constant burning in the *urethra*, especially at the *glans*. A stone of any considerable size may be distinguished by the finger in the *rectum*, but most certainly by a metallic sound introduced into the *urethra*, which is either stopped by the stone, or passes near it into the bladder.

2141. If it be not possible, after the previous enlargement of the *urethra* with large bougies passed down to the stone, to grasp it with

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(*a*) Clark's Case Book. (*b*) Taylor's Catalogue. (*c*) Practical Surgery.

Hunter's or Cooper's forceps, or Civiale's instrument, in doing which, the introduction of one or two fingers into the *rectum*, so as to press against the stone, prevents its being pushed back into the bladder, and then extract or thrust it back into the bladder, (*par.* 2052,) it must be removed by a cut. If a staff can be introduced close to the stone, into the bladder, a cut must then be made, as in the lateral operation, into the prostate and part of the neck of the bladder, its situation ascertained by the finger, and the size of the cut increased as may be necessary. The staff must now be removed, and with the finger passed into the *rectum*, it must be attempted to press the stone out, or at least prevent it getting back into the bladder, so that it may be removed with the forceps, or with a scoop. If the staff cannot be passed into the bladder, it must be carried down to the stone, the membranous part of the *urethra* opened upon it, and a director tried to be passed into the bladder, upon which its neck is to be sufficiently cut into. If the staff cannot be introduced into the bladder, its neck must be divided up to the stone, which must be pressed up from the *rectum*, and even cut upon. After the removal of the stone, the finger or the sound should always be passed into the neck and body of the bladder, to ascertain whether there be any stones remaining.

If, during the examination with the sound, the stone be forced back into the bladder, it must be crushed.

[When a stone is found lodged in the *urethra*, and more especially if it be far down that canal, the greatest care must be taken that it be neither pushed back by the sound, nor allowed to slip back in the handling; as if this happen, it will be necessary either to cut into the bladder, or to attempt crushing, as Chelius recommends, which places the patient unnecessarily in a very unsatisfactory condition.—J. F. S.]

2142. If the stone lodge in the membranous part of the *urethra*, it may increase on account of the yielding of the urethral wall, and easily destroy it by ulceration and fistulous openings. If the stone cannot be removed by the use of lukewarm baths, by the gradual enlargement of the *urethra* with bougies, by gentle pressure, or by the already-mentioned forceps, it must be taken out by a cut, in which case the stone should be pressed against the *perinæum* by the finger in the *rectum*, and then cut upon in an oblique direction, from the *raphe* to the ischial tuberosity. After the removal of the stone, a thick elastic catheter should be introduced into the bladder and the wound closed with sticking plaster.

2143. If the stone be situated in the spongy part of the *urethra*, it may most commonly be got rid of by the use of soothing baths, by the enlargement of the *urethra*, by pressing it forwards, or by means of the forceps already mentioned, or by a loop of wire. If these means be ineffectual, or the symptoms urgent, a cut must be made on the stone, which should be fixed with the fingers of the left hand, and then pulled out; after which a catheter is to be introduced, and the wound carefully closed. If the stone have been long retained, and the walls of the *urethra* be much distended and changed, an incurable fistula very easily occurs. If the cut be requisite in the region of the *scrotum*, which should be carefully avoided for fear of urinary infiltration, it must be made through the skin made tight, but not dragged out of place, sufficiently behind, and care taken for the due passage of the urine by the inlying of a catheter.

2144. If the stone be stopped in the *fossa navicularis*, and cannot be removed on account of the narrowness of the orifice of the *urethra*, the orifice must be slit towards the *frænum*.

In rare cases the whole *urethra* has been so filled with stones up to its mouth, that even the smallest sound could not be introduced. Under these circumstances the *urethra* must be opened at several parts, and if vesical stones be present, a cut made even into the bladder itself (*a*).

[If a stone be anywhere in front of the *scrotum*, it can most commonly, and should be extracted without cutting; for, as Liston very justly observes, "owing to the thinness of the coverings, it will be found a most difficult matter to close entirely any opening anterior to the *scrotum*." (p. 520.) I have frequently succeeded, by following the advice of the younger Cline, in getting out a stone so lodged, though at first the attempt seemed very unpromising, by a very simple contrivance, but persevered in with patience. This consists, in first nipping the *urethra* tightly behind the stone, so as to prevent it slipping backwards, and then introducing an eyed probe, with its eyed end a little bent, so as to form a sort of spoon or loop; it is to be gently insinuated between the wall of the *urethra* and the stone, till its point have got completely behind the latter. Then pressing the stone forwards with the thumb and finger, which grasps the *urethra*, the probe is gently and by little jerks to be drawn forwards, bringing with it the stone, which is to be closely followed with the thumb and finger of the other hand. By thus proceeding with patience, the stone is after some time brought up to the *glans*, and if the lips of the *urethra* be there too narrow to allow its passage, the *urethra* may be cut through by the side of the *frænum* with a lancet, and the stone is immediately set free.

Should I meet with a case of this kind in which I was foiled, I am inclined to think that, rather than cut on the stone from without, I should pass a *phimosis*-knife down the *urethra* to the stone, and cut through its lining membrane into the spongy body of the *penis* sufficiently to enable the stone to move forwards, running the risk of infiltration of urine, which I should not much dread, by passing a catheter occasionally during the day to draw off the urine, or leaving it in, so that the water might flow away constantly. If infiltration did not ensue, there would probably be some temporary narrowing of the *urethra*, which might be cured by perseverance in the use of bougies. Anything is better than an urinary fistula, which becomes the more serious in proportion as the *urethra* is opened near the front of the *scrotum*, in consequence of the readiness with which the urine will escape into the loose cellular tissue of that part, causing troublesome abscesses and even gangrene.—J. F. S.]

VI.—OF URINARY STONES EXTERNAL TO THE URINARY PASSAGE.

2145. Stones which are found external to the *urethra*, in the neighbouring cellular tissue of the *perinæum*, (*perinæal stones*,) or in the *scrotum*, (*scrotal stones*,) are either such as have been deposited in the cellular tissue by the destruction of the walls of the *urethra*, and have grown by the continual deposition of the phosphates, or have been produced by the penetration of the urine into clefts of the *urethra*, into fistulas, wounds, and the like, into the cellular tissue itself. If the urine penetrate into several spaces of the cellular tissue, several stones may be formed at the same time. Such stones are easily distinguished by hard, nearly painless, frequently very large, swelling; often by the introduction of a sound into the *urethra*, when they partially project into it. They frequently cause suppuration and fistulous passages, through which a metal sound easily finds the stone. They are not rarely discharged by suppuration, in consequence of which incurable fistulas remain, if the wall of the *urethra* have been destroyed to any great extent (1).

By the destruction of the walls of the *vagina* in women, and of the *rectum* in men, vesical stones may lodge in these cavities and be discharged.

[(1) A very remarkable instance of a large collection of perinæal stones occurred to Vincent (*b*) in St. Bartholomew's Hospital in 1843. A young man, twenty-three years of age, suffered from incontinence of urine during the ten previous years, in consequence of having received at that time a kick on the *penis* from a horse; for this he had constantly worn a yoke. Four years after he had bleeding from the *urethra*, which was followed by a swelling behind the *scrotum*, and this, at the period of his admission, had

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(*a*) Klein, in Neuen Chiron., vol. i. p. 78.

(*b*) Taylor's Catalogue of Calculi, above quoted. Appendix.

acquired the size of a goose's egg. Upon this VINCENT cut, "and gave exit to a hundred and forty-six *calculi* of various figures and sizes, the largest being about the size of a horse bean. After the pouch had been emptied, there were several in that part of the *urethra* next the bladder which were removed, and two of the number came away the next day. The cyst consisted of a dense and tough membrane like parchment. It communicated with the *urethra* its whole length, and graduated into it, so as to offer no abrupt nor partial connexion with it, and appeared to be formed by its dilatation. After the operation the patient retained his urine, passing it voluntarily through the wound. The stones consist of the *fusible* compound mixed with thin alternate layers of urate of ammonia, which are more abundant at the centre of each *calculus*; the urate, however, does not constitute a distinct *nucleus*." (pp. 137, 38.)

In the College Collection there is also another very curious case of VINCENT'S:—"Numerous small *calculi*, which with about two hundred others, were removed from between the prepuce and *glans penis* of a very old man. The patient had congenital *phimosis*, the orifice of the *urethra* scarcely admitting the introduction of a common probe. From the presence of the *calculi*, the prepuce was distended to the size of a large pullet's egg, and retention of urine was finally produced. On dividing the prepuce, one of the *calculi* was found completely blocking up the orifice of the *urethra*. The *glans penis* was in a state of ulceration, and a large portion of its substance had been absorbed. The patient had, during many years, occasionally experienced great pain and difficulty in making water, and latterly he had a constant *stillicidium*. The *calculi* are composed principally of the fusible compound; most of them have a small *nucleus* of uric acid; their external surface is varnished over with urate of ammonia. From the composition of the *nucleus*, there can be no doubt but that the greater number of these *calculi* had passed from the *urethra* into the sac of the prepuce; and their irregular form and close adaptation to each other, proves that in this situation they had increased considerably in size by the deposition of the earthy phosphates." (pp. 39, 40.)]

2146. These stones may be removed by sufficiently cutting on the parts containing them; and if the stone be in the *perinæum* and deeply lodged, attempts should be made from the *rectum* to press it through. If the cavity in which the stone lies, be very large and hardened, it may be advisable to remove part of its walls. The after-treatment must be conducted according to the rules laid down for urinary fistula.

Further notice of this subject may be found in

LOUIS, Mémoire sur les Pierres hors des voies naturelles de l'urine; in Mém. de l'Acad. de Chirurg., vol. iii. p. 332.

ILSE; in Medical Observations and Inquiries, vol. v. p. 336.

WALTHER; in Salzburg Med.-chir. Zeitung, vol. ii. p. 253. 1812.

KLEIN; in neuen Chiron, vol. i. p. 16.

GRAEFE, Ueber Scrotal-Steine; in his Journal für Chirurgie und Augenheilkunde, vol. iii. pt. iii. p. 400—pt. iv. p. 695.

CHELIUS, Ueber Scrotal-Steine; in Heidelb. Med. Annalen, vol. i. pt. i.

[VII.—OF PROSTATAL STONES.

Stone is occasionally formed in the prostate gland. This, "though not of urinary origin," remarks PROUT (*a*), "is very liable to be mistaken for such, from the situation in which it is formed. Of this there seems to be two varieties. The first variety is usually formed in the natural cavities of the gland before it becomes much disorganized. They are generally small, and more or less rounded in shape, and of a yellowish-brown colour. The second variety seems to be generally found in abscesses of that gland, where they are sometimes met with in great numbers. These are usually of much larger size than the first variety, and have a highly polished porcelainous appearance. The composition, however, of both varieties is essentially the same; that is to say, they consist

(*a*) Inquiry above cited.

chiefly of the phosphate of lime; a substance which appears to be never deposited in an unmixed state by the urine. Hence the prostatal *calculi* can be always readily distinguished from those of urinary origin." (p. 94.) Astley Cooper (*a*) says, the largest he has seen "are not bigger than a pea, and they seldom are so large but their numbers are sometimes very considerable." (p. 295.) In a preparation of this disease in St. Thomas's Museum, the prostate is studded with little stones like pins' heads of various size. Astley Cooper mentions, that in a case under his care, "these *calculi* had produced not only painful feelings in the *perinæum*, but a degree of irritation which kept the patient in continued mental excitement bordering on insanity." (p. 296.) They are usually accompanied with difficulty in passing the water; may be felt as the catheter passes over them into the bladder, and by the introduction of the finger into the *rectum*.

These prostatal stones must be removed by cutting through the *perinæum* into the prostate gland, and picking them out.

[I am doubtful whether the following is to be considered as a prostatal stone, or merely a stone encysted close to the gland, but it has much practical interest, and may be conveniently mentioned here. A man about middle age applied several years since to my friend Green, labouring under symptoms of stone in the bladder. He was sounded, and a stone felt but obscurely; he was sounded again at some interval, and with the same result; the operation was therefore deferred, and a few months after he died of some other complaint. On *examination* no stone was found in the bladder, although sounding immediately before had given the same indistinct sensation. The bladder, *penis*, and neighbouring parts were therefore removed for closer inspection, and it was then found that there was a long narrow stone embedded in a cyst *before* and *below*, but in such way that had the lateral operation been performed, and the prostate divided in the usual way, the forceps would probably have entered the bladder without detecting the stone in their passage, and consequently the operator would have had the vexation of supposing the patient had been operated on without really having a stone; although as the sound passed over it had received the indistinct impression before mentioned.—J. F. S.]

Note on Constitutional Stone-Solvents.

I have to thank my friend Travers for the following interesting case which fell under his own immediate observation, and which is the best authenticated throughout of any case I have heard of. The fragments of the stone are in his possession.

A tailor who had long laboured under symptoms of stone was sounded by Travers a few years since, who detected a hard *calculus* of some size, and counselled immediate operation. The man being afraid to incur the risk of the proceeding, put himself under the care of a person at Henley-in-Arden, who administered a constitution water to the extent of two or three pints *per diem*.

The patient soon began to pass fragments in quantity, as after the operation of breaking, the act being attended with acute pain, both before and during micturition. The pain and discharge of fragments continued for many months; both subsided at last and at the same time. The patient on one occasion shewed him a box full of fragments, for the most part reduced to a powder.

This man was examined after death by Dr. Charles of Putney, and no trace of stone was discovered in the bladder.

Dr. Prout stated the basis of the "drink" to be carbonate of soda and potass, with a little nitre, in the following proportions:—

Sodæ carb.	gr. x.
Potass. carb.	gr. viij.
——— nitrat.	gr. ij.

(*a*) Surgical Lectures, vol. ii.

STATISTICAL ACCOUNT OF THE OPERATIONS FOR THE STONE IN ST. THOMAS'S HOSPITAL, FROM 1800 TO 1846.

The following is the account of operations for the stone which have been performed in St. Thomas's Hospital since 1800; and I have to thank my friend NASH for the kind assistance he has rendered me from the steward's office books, which unhappily are, with but few exceptions, the only records kept before 1820. I have also used GREEN'S case-books, some of which are missing, CLARK'S, and my own books, the ward books, and the Lancet, from which I have derived great assistance.

In the first table are the gross number of cases operated on in each year. In the second table I have given the dates and the results, with the circumstances of the cases where important, as far as I have been able to obtain them. I am sorry, however, that the reports are so meagre, but still they are highly important, as showing that the lateral operation is neither so dangerous, nor so much to be dreaded, if the after-treatment be well attended to; and also that the cutting gorget does not deserve the obloquy which of late years it has been the fashion so freely to heap upon it.

In the cases recorded in the second table, the gorget was always used by the elder TRAVERS, GREEN, MACKMURDO, the younger TRAVERS, and myself; TYRRELL, SOLLY, and CLARK operated with BLIZARD'S knife, its beak, however, being straight.

TABLE I.

GROSS NUMBER of OPERATIONS for the STONE, from 1800 to 1846.

1801	12	1813	7	1825	4	1837	10
1802	12	1814	2	1826	5	1838	7
1803	1	1815	8	1827	7	1839	1
1804	6	1816	5	1828	13	1840	7
1805	11	1817	2	1829	9	1841	6
1806	4	1818	7	1830	10	1842	4
1807	3	1819	8	1831	6	1843	7
1808	11	1820	8	1832	4	1844	6
1809	4	1821	4	1833	5	1845	2
1810	2	1822	7	1834	5		
1811	15	1823	11	1835	5		295
1812	4	1824	10	1836	8		

TABLE II.

The Initials under the Surgeon's column mark the operator. Up to 1837, the elder TRAVERS, GREEN, and TYRRELL, alone operated; but in that year, whilst Assistant Surgeon, was my first operation. After the retirement of TRAVERS, and my appointment as Surgeon, in 1841, MACKMURDO, SOLLY, and the younger TRAVERS, became Assistants; and on the death of TYRREL, in 1843, MACKMURDO took his place, and CLARK became junior Assistant. This notice is necessary, as a key to the Table.

	Age.	Admitted.	Cut.	Cured.	Surgeon.			Remarks.
1822. (Seven.)								
James Townrow . . (Ward Book).	.	May 30	June 7	July 4	.	G.	.	
Elizabeth Dunthorne (Ward Book).	.	June 6	July 12	Aug. 22	.	G.	.	
Robert Brown . . . (Ward Book).	.	Aug. 1	Aug. 23	Sept. 26	.	G.	.	
Charles Johnson . . (Ward Book). (*a*)	.	Aug. 24	Oct. 15	Nov. 12	.	G.	.	

(*a*) The names of the remaining patients cannot be ascertained; but the total number is obtained from the Steward's report in Table I.

	Age.	Admitted.	Cut.	Cured.	Surgeon.				Remarks.
1823. (Eleven.)									
Henry Hide . . . . (Lanc. vol. i.)	6	Oct. 30	Nov. 7	Dec. 13	Tr.	.	.	.	Stone as large as pigeon
John Catt . . . . . (Lanc. vol. i.)	39	Nov. 22	Nov. 28	Dec. 22	Tr.	.	.	.	Stone rather larger crown-piece, not very Uric acid. Had slight ing on same evening, was soon stanched.
James Connor . . . (Ward Book.) (*a*)	.	Sept. 4	.	Jan. 4, 1824.	.	G.	.	.	
1824.									
A Boy . . . . . . (Lanc. vol. ii.)	3	.	Feb. 13	.	.	.	Tyrr.	.	Two stones removed.
William Hart . . . (Ward Book).	.	April 28	May 21	July 15	.	G.	.	.	
Henry Prince . . . (Lanc. vol. ii.)	3	Nov. 4, 1823.	Mar. 12	April 29	Tr.	.	.	.	Stone not found at oper but afterwards in a c the floor, size of a pe oblong. Soon after h mission a small ston extracted from opposit *num*. Afterwards a scess formed behind *sc* which was opened, an days after another phosphate stone wa moved from this part *urethra*. Severe sym of stone continued child was sounded, felt and the operatio formed as above state
James Wood . . (Lanc. vol. iii.)	64	April 8	April 23	June 3	.	.	Tyrr.	.	Stone very soft, and sm in its extraction. stones had been re from the *urethra* on t following his admissi
Richard Stevens . . (Lanc. vol. iii.)	4	Feb. 16	April 23	June 7	.	.	Tyrr.	.	
William Hart . . . (Ward Book.-Lanc. vol. iii.)	31	April 28, 1823.	May 21	July 15	.	G.	.	.	Stone, size of an almon the shell on; soft and at one point; a smal tion broken off in t traction.
A man . . . . . . (Lanc. vol. iii.)	.	.	May 28	.	.	.	Tyrr.	.	
William Padyham. . (Lanc. vol. iv.)	.	Aug. 16	Aug. 27	.	.	.	Tyrr.	.	
William Dean . . . (Ward Book).	.	Oct. 7	Oct. 22	Nov. 28	.	G.	.	.	
A man . . . . (Lanc. vol. v.)	.	.	Dec.	.	.	.	Tyrr.	.	
1825.									
James Conner . . . (Lanc., vol. vi.) (see 1823.)	4	Feb. 10	Feb. 26	Mar. 25	.	G.	.	.	Operated on in 1823. (stone, inch long, hal wide.
Samuel Sparkes. . . (Green's Book.)	7	Aug. 3	Aug. 9	Sept. 12	.	G.	.	.	Flattened round stone, inches around, rough
William Dean. . . . (Green's Book.) (see 1824.)	45	Oct. 4	Oct. 14	Feb. 2[illegible], 1826	.	G.	.	.	Had been cut in Oct., stone broke in prese ration; passed frag on second and third
John Peak . . . . . (Lanc., vol. ix.)	7	Nov. 3	Nov. 11	Dec. 15	Tr.	.	.	.	Stone large: had shiv fifth day.

(*a*) The names of the remaining patients cannot be ascertained; but the total number is obtained from the St report in Table I.

	Age.	Admitted.	Cut.	Cured.	Surgeon.				Remarks.
1826.									
thony Willsmore Lanc., vol. ix.)	12	Feb. 23	Mar. 3	April 24	.	G.	.	.	Oxalate of lime.
ırles Cruden . . . Lanc., vol. x.)	2¼	June 1	June 2	June 29	Tr.	.	.	.	Size of sparrow's egg.
ber Humphrey. . Lanc., vol. x.)	17	June 29	July 3	Aug. 9	.	G.	.	.	Size of walnut. In same evening patient attacked with great pain in *abdomen*, with high excitement; arising from accumulation of urine, from closure of wound; a catheter passed through it, and symptoms ceased, but required to be passed next day; no further trouble.
n Palmer . . . . ,anc., vol. x.)	17	July 8	July 21	Aug. 25	.	.	Tyrr.	.	Stone size of horse chestnut; flattened, and rough.
n Newman . . . Green's Book).	7	Nov. 25	Nov. 25	Jan. 25	.	G.	.	.	Stone as big as top of little finger, and grape-shaped, in bulb of *urethra*, causing retention of urine; removed by cut in *perinæum*. He had been repeatedly sounded, but the stone never felt.
1827.									
n Bone	66	Feb. 15	Feb. 22	April 3	.	G.	.	.	
ert Gosling or osden	9	Mar. 8	Mar. 16	May 17	.	G.	.	.	
ıry Richardson . ,anc., 1827-28; ıl. i.)	81	June 8	June 22	[a]	Tr.	.	.	.	Stone size of a pigeon's egg immediately, after which, with much difficulty, a second as large as a pullet's egg; much venous bleeding at operation; on *third* day powers failed, and died on *fourth*. Large stone in right ureter, and same kidney wasted; bladder much thickened, with spots of ulceration; prostate enlarged, and almost cartilaginous.
ard Row	23	Aug. 8	Aug. 10	Sept. 11	.	G.	.	.	
ı Gilby.	1¼	Aug. 25	Aug. 25	Sept. 4	.	G.	.	.	
es Sharp . . . . ,anc., 1827-28; l. i)	9	Sept. 19	Sept. 27	Nov. 15	.	G.	.	.	Stone oval; flattened, size of a shilling, rough; oxalate of lime.
'ge Butler . . .	4	Nov. 29	Dec. 7	Jan. 3, 1828.	Tr.	.	.	.	Stone as large as hazel-nut.
1828.									
Baker. . . . . anc., 1827-28; l. ii.)	2	Feb. 28	Mar. 7	April 10	.	G.	.	.	Stone size of a horse bean.
Chaplin. . . . anc., 1827-28; l. ii.)	25	April 9	April 18	June 14	Tr.	.	.	.	Stone size of a pullet's egg, rough; considerable bleeding some hours after; stopped by pressure. Much constitutional excitement, and sickness for first five days.
Gilby. . . . . eward's book).	2¼	April 26	.	May 8	Tr.	.	.	.	
s Gardner . . . anc., 1827-28; . ii.)	4	Aug. 4	.	Oct. 2	.	.	Tyrr.	.	First division of prostate not sufficient, therefore a second; stone small and oblong; seized with difficulty, as lodged behind a fold of bladder, and lying behind and below left of prostate.
erick Hinckley . ınc., 1827-28; . ii.)	6	Aug. 14	Aug. 19	Oct. 2	.	G.	.	.	Stone large and irregular.
Maybank . . . ınc., 1828-29; . i.)	21	Sept. 4	.	Nov. 6	.	G.	.	.	Stone of large size.

Died. [a] June 25, 1827.

	Age.	Admitted.	Cut.	Cured.	Surgeons.				Remarks.
1828—*continued.*									
Thomas Gash. . . . (Steward's book.)	4	Oct. 1	.	Nov. 20	.	G.	.	.	
William Shaw. . . . (Steward's book.)	7	Oct. 12	.	Dec. 25	.	G.	.	.	
Edward Harrison . . (Lanc., 1828–29; vol. i.)	9	Oct. 18	Oct. 24	Jan. 22, 1829.	.	G.	.	.	Stone large. Attacked *peritonitis* on *second* d
George Hull . . . . (Steward's book.)	17	Nov. 27	.	Feb. 24, 1829.	.	G.	.	.	
John Hunt . . . . . (Steward's book.)	.	Dec. 15	.	Feb. 7, 1829.	.	.	Tyrr.	.	
William Dean. . . . (St. Thos. Med. Soc. Minute-book.) (see 1824–25.	.	Dec. 12 1827.	Mar. 7	[*a*]	.	G.	.	.	*Third* operation, a Green's advice; cut on inner side of scar; difficulty in intro gorget, on account of ness of prostate; broken to pieces, a moved piecemeal, b cleus remained, and sary to enlarge woun straight knife, then and extracted in two operation forty min
1829.									
Henry Kate . . . . (Lanc., 1828–29; vol. i.)	62	Jan. 9	Feb. 30	[*b*]	.	G.	.	.	Two stones; first o size; second bro pieces, partially re with scoop, and wash by injecting warm patient much exhau
William Hoy. . . . (Lanc., 1828–29; vol. i.)	10	Jan. 13	Feb. 20	Mar. 23	.	.	Tyrr.	.	Stone of large size.
Thomas Kittam. . . (Lanc., 1828–29; vol. i.)	62	Feb. 26	Mar. 6	April 30	.	.	Tyrr.	.	Stone large, oval, flat; w above ℥ij.ss. Soo operation bleeding pint; stopped by p
William Curtis . . . (Lanc., 1828–29; vol. ii.)	23	May 14	May 22	Aug. 6	.	G.	.	.	Stone circular and fla inch and half in di half-inch thick; two processes simil pair of horns, each half an inch long. at first passed ove on which they grat did not find it in b was lodged in a cys anterior part of gland, communicati *urethra.*
William Kemp. . . (Lanc., 1828–29; vol. ii.)	10	June 16	June 26	June 24	.	.	Tyrr.	.	Large oblong stone, long.
William Figg. . . . (Lanc., 1828–29; vol. ii.)	12	June 25	July 16	Aug. 6	.	G.	.	.	Stone shape of flat pe
John Holden . . . . (Green's book.)	73	Oct. 22	Nov. 6	Dec. 17	.	G.	.	.	Has frequently voide as pin's-head stone size of a peach smooth, with soft which crumbled.
Henry Jeffs. . . . . (Green's book.)	12	Oct. 22	Oct. 30	Jan. 7, 1830.	.	G.	.	.	Stone round, as lar walnut, tuberculat alate of lime.
Henry Moffett . . . (Clark's book.)	60	Dec. 3	Dec. 18	Jan. 14, 1830.	Tr.	.	.	.	Has occasionally pass stones from childh had a stone extrac bladder before he then a stone remo urethra by Cline; small fistulous o junction of *penis* w *tum*, and stone fo down; removed b uric acid.

Died. [*a*] March 11, 1828. [*b*] March 2, 1829.

	Age.	Admitted.	Cut.	Cured.	Surgeon.				Remarks.
1830.									
ert Wheatler, or Vhittesley.	66	Jan. 13	Jan. 26	April 15	.	.	Tyrr.	.	
rge Birkett . . .	4	Jan. 28	Feb. 5	Mar. 11	.	.	Tyrr.	.	
rge Tipper . . . Lanc., 1829-30; ol. ii.)	55	Mar. 25	April 1	May 13	.	G.	.	.	Nothing particular.
es Taylor . . . Lanc., 1829-30; ol. ii.)	14	Mar. 25	April 5	Oct. 7	.	G.	.	.	No difficulty in operation, but size of stone not mentioned. Not more than four ounces of blood lost at operation; but an hour after he became pallid, faint, and cold; in evening pulse very small and quick, and very restless; ammonia and opium given, which were soon rejected, but solid opium retained. During night he sunk still more, and on following morning the pulse was scarcely perceptible; countenance cadaverous; thirst extreme; brandy then given, but thrown up, but ammonia with lemon juice retained, and gin every four hours. On *third* day was better, and sickness subsiding; port wine given. On *fourth* day reaction had taken place, and he had great tenderness of the lower part of the belly; castor oil ordered, and repeated in evening, and hot poultices to the belly. In the course of the night the bowels were freely opened, and he was much better on the *fifth* day. The wound was still pale, but the urine flowed freely through it; on each side of the *raphe* a dark purple spot; was allowed a chop and porter and eggs. On *sixth* day had pain in *perinæum;* and on same evening became suddenly faint, the limbs thrown forcibly out, and he appeared dying, but recovered by sprinkling with cold water. On *ninth* day quinine ordered; on *twelfth* day pus discharged from the wound; and on *fifteenth* a considerable slough removed, after which half a pint of pus discharged. From this time he gradually improved.
hen Kensley . . anc., 1829-30; l. ii.)	5	April 6	April 14	June 10	.	G.	.	.	Stone size of filbert; uric acid.
liam Saxbee. . . reen's book.)	66	May 27	June 4	[*a*]	.	G.	.	.	Moderate-sized stone; superficial perinæal artery tied at operation; wound attacked with erysipelas on tenth day, probably caught from patient near him, which extended to thighs; slough on buttock; cellular tissue on one side of *scrotum* sloughy; no peritonæal inflammation nor other internal mischief.
hen Saxbee. . .	59	July 22	July 29	Sept. 9	.	.	Tyrr.	.	
nas Dove Green's book.)	4	Aug. 24	Aug. 31	Oct. 7	.	G.	.	.	Stone large.
Mason	14	Oct. 28	Nov. 5	Dec. 23	.	.	Tyrr.	.	Oxalate of lime.
1831.									
beth Cook . . .	9	Jan. 25	Feb. 1	April 14	.	G.	.	.	
Wilkinson . .	21	Feb. 3	Feb. 17	Mar. 24	.	G.	.	.	
nas Hingeston reen's book.)	4	Feb. 15	Feb. 25	Mar. 14	.	G.	.	.	Small flat stone, uric acid; attacked with *peritonitis* on *sixth* day.
nas Goodsoul .	56	Feb. 21	Feb. 28	Mar. 21	.	.	Tyrr.	.	
nas Folkes . . .	40	Aug. 11	Aug. 15	Sept. 10	.	G.	.	.	Stone in the *urethra*.
nas Thorpe . .	32	Nov. 8	Nov. 12	Dec. 18	.	G.	.	.	
1832.									
ge Stinton . . .	5	Feb. 23	Mar. 2	April 12	.	.	Tyrr.	.	
nas Brumer reen's book.)	45	May 2	May 22	July 5	.	G.	.	.	Stone large as crown piece, weighed ʒxiv.; artery of bulb divided, bled freely, and tied at once, but not efficient, and therefore pressure for four hours, effectual.
les Tighe . . .	19	July 2	July 13	Aug. 18	.	.	Tyrr.	.	
y Baron	26	Aug. 2	Oct. 26	Nov. 29	.	G.	.	.	
1833.									
rd Verle . . .	36	Feb. 28	April 12	[*b*]	.	G.	.	.	
h Wheeler . . .	15	June 13	July 5	Aug. 6	.	G.	.	.	
rt Willis. . . .	63	Sept. 19	Oct. 4	[*c*]	Tr.	.	.	.	
as Hannam . .	3	Oct. 2	Oct. 11	Nov. 22	.	G.	.	.	
Henry Burt . .	4½	Nov. 19	Dec. 6	Jan. 24, 1834.	.	G.	.	.	

Died. [*a*] June 21, 1830. [*b*] April 13, 1833. [*c*] November 10, 1833.

	Age.	Admitted.	Cut.	Cured.	Surgeons.				Remarks.
1834.									
John Holden	55	Mar. 14	April 4	[*a*]	.	G.	.	.	
William Batt	60	Mar. 27	April 4	[*b*]	.	G.	.	.	
Frederick Norman .	.	Aug. 22	.	Sept. 4	.	G.	.	.	
William Roderick . .	12	Oct. 28	Nov. 7	Dec. 18	.	G.	.	.	
William Thomas . .	12¼	Oct. 30	Nov. 7	Dec. 18	.	G.	.	.	
1835.									
John Symons. . . .	14	Jan. 1	Jan. 16	Feb. 19	.	G.	.	.	
John Medden. . . .	4	Feb. 17	Feb. 27	April 13	.	G.	.	.	
Abraham James. . .	2¼	May 22	July 3	Aug. 9	Tr.	.	.	.	
John Wakefield. .	4	July 21	July 31	Sept. 4	.	G.	.	.	
Richard Beet	32	Nov. 25	Dec. 11	April 22, 1836.	.	.	Tyrr.	.	
1836.									
Andrew Martin. . .	5	Dec. 15, 1835.	Jan. 29	Mar. 11	.	G.	.	.	
Thomas Popkins . .	12	Sept. 17, 1835.	Feb. 12	Mar. 31	.	.	Tyrr.	.	
Joseph Anderson . .	2¼	Mar. 24	April 2	May 11	.	.	Tyrr.	.	
William Garland . .	4	July 26	Aug.	Sept. 17	.	G.	.	.	
Hazael Weble. . . .	4	Aug. 25	Sept. 23	Oct. 25	Tr.	.	.	.	
Robert Weddon. . .	2¼	Nov. 2	Dec. 9	Jan. 24, 1837.	.	G.	.	.	
Robert Taunton. . .	10	Nov. 7	Dec. 9	Jan. 24, 1837.	.	G.	.	.	
George Adams . . .	5	Nov. 24	Dec. 9	Mar. 11, 1837.	.	G.	.	.	These last four y from the Steward's
1837.									
Felix Aug. Davenport	12	Nov. 8, 1836.	Jan. 20	Feb. 22	.	.	Tyrr.	.	
William Stokes. . .	2	Feb. 21	Feb. 25	[*c*]	Tr.	.	.	.	
George Lucas. . . .	19	Jan. 19	Feb. 3	Mar. 9	.	.	South.	.	Stone weighed ℥iij. ℈ bleeding from artery soon after o and three hours a stopped by pressu
Henry Peverill . . .	71	June 1	June 24	[*d*]	.	.	South.	.	Stone crushed. U stone of ℥vij. ℈ij.
James Row.	3	Nov. 22, 1836.	June 2	July 2	.	G.	.	.	
William Perry . . .	2¾	June 26	Sept. 2	Sept. 23	.	G.	.	.	
Henry Turner . . .	2¼	Aug. 18	Sept. 2	Sept. 25	.	G.	.	.	
William Sheldrake .	57	Aug. 22	Sept. 16	Oct. 24	.	.	South.	.	Stone broke in ex prostate very la bleeding for sh stopped by press sloughy wound.
John Hawes	4½	Sept. 12	Sept. 30	Oct. 25	.	G.	.	.	
John Pratt	19	Sept. 14	Sept. 30	Oct. 26	.	.	South.	.	Free bleeding from perinæal, which and from artery internal pudic ; pressure seven h
1838.									
Henry Warman. . .	50	Jan. 2	Feb. 10	Mar. 13	.	.	Tyrr.	.	
James Harding . . .	17	Jan. 23	Feb. 10	April 10	.	.	Tyrr.	.	
Thomas Bull	75	Mar. 14	Mar. 31	May 29	.	.	Tyrr.	.	
Thomas Williams. .	3	Mar. 19	Mar. 19	April 17	.	.	South.	.	Stone in urethra, tention of urine.
William Brockwell .	4	July 31	Aug. 4	Sept. 1	.	Tyrr.	.	.	
George Thornton . .	10	July 26	Aug. 18	Sept. 25	.	Tyrr.	.	.	
John Slinn	23	Nov. 23	Nov. 30	[*e*]	.	Tyrr.	.	.	A great gin-drinke course of the

noon, but stanched by pressure Passed no water till f *second* day, when the finger passed through wound into t and the water then flowed freely. Passed clots several till death. Became excessively irritable, but always quie which was given freely ; but not to the amount it afterwar he had been accustomed to take.

	Age.	Admitted.	Cut.	Cured.	Surgeons.				Remarks.
Henry Forster . . .	13	Nov. 27	Dec. 15	[*f*]	.	.	South	.	Oxalate of lime belly next day : day bleeding repeated frequ wards. Case giv

Died. [*a*] April 7. [*b*] April 14. [*c*] Feb. 26. [*d*] July 1. [*e*] Dec. 8. [*f*] Ja

2138. If now, after the consideration, founded on experience, of the advantages and disadvantages of lithotomy and lithotrity, the particular cases in which the one or other practice is specially indicated, be reviewed, it follows that lithotrity appears preferable, *first*, in small stones or those of no great size; *second*, when there are two, or several little stones; *third*, in stones of moderate size, and when they can be easily broken, and if in all these cases the bladder be healthy, or only in a trivial degree affected. These indications are more important, when such cases occur in old persons, in females, or in very stout people. On the other hand, lithotomy is decidedly to be preferred; *first*, in childhood; *second*, with large and hard, and especially mulberry stones; *third*, when there are several large stones; *fourth*, when large stones entirely fill, or are completely locked in by a contracted and unextensible bladder; *fifth*, in diseased prostate, or severe affection of the bladder; *sixth*, in very great sensibility of the bladder, so that the patient can bear neither its distension, nor the motion of the instruments; *seventh*, with stones, of which the *nucleus*, as, for example, when it is a bullet or the like, cannot be destroyed by the lithotriptor. It is also not to be overlooked, that in the general employment of lithotrity, the patient should be subjected to it early, by which its results are more certain, and its use will become more easy and general. On the other hand, however, it must not be unnoticed, that under directly the same circumstances, which are favourable for crushing, does cutting for the stone, if performed with ability, lose much of its danger.

Strictures of the *urethra* are only temporary contraindications for lithotrity, and equally applying to lithotomy, they must be first got rid of. Palsy of the bladder neither contraindicates lithotrity, nor renders its performance difficult. Should the fragments of the stone indeed be discharged more slowly or with difficulty, this may be easily overcome by injections; and experience has shown that the palsy of the bladder has been relieved, and even removed, by the effect of the lithotriptic operation, which, however, has also been several times noticed after lithotomy.

["Since commencing the practice of lithotrity, I have found," says Key, "that more than half the number of adults who have come under my care have been fit subjects for the operation; and that in the majority of persons afflicted with *calculus*, it has decided advantages over lithotomy. One among the principal advantages which lithotrity has conferred on Surgery is the early application which patients are induced to make for the relief of their disorder. Formerly * * * the disease was associated in their minds with a most painful and dangerous operation, that must be had recourse to, as a last remedy, when palliative measures failed to afford relief to their sufferings. The dangers and sufferings of lithotomy, magnified as they were by the patient's fears, often deterred him from applying for medical assistance when the pains of stone first came upon him, by the dread of having his worst fears confirmed. Even if the presence of a stone in his bladder were ascertained, it was, in too many instances, allowed to remain undisturbed, in the vain expectation that it might not increase in size, and that the severity of pain might continue to be mitigated by the medicines that so often had been found to assuage his pangs. The operation was thus procrastinated until the stone acquired a large size, often until the bladder had become diseased, and the patient's health undermined by protracted sufferings. * * * Nor has lithotrity been without its influence on the Surgeon. Formerly, when a patient first consulted him for symptoms of *dysuria*, followed by pain, he was content to palliate the malady by sedative and alkaline medicines, regardless whether they were caused by prostatic affection, stone, or any other local disturbance. The use of the sound was deferred: that could be used at any time: and, usually, it was first introduced into the bladder when the patient's sufferings had become severe and protracted. * * * The operation of sounding was also conducted in a slovenly manner. If the stone were not discovered when small, it would be when large, and no advantage was gained by operating in the early stage. Now, the Surgeon examines the bladder with great care, knowing the importance of discovering the *calculus* at the earliest period, he no longer leaves its existence a matter of doubt, but proceeds at once to examine the bladder, and determines its presence; or by a skilful searching of every part of the *viscus*, ascertains that a stone does not exist. * * * The early symptoms of the disease are thus watched with more jealousy on the part of the Surgeon, and are not so scrupulously concealed by the patient. The advantages of an early knowledge of the existence of a stone, and of prompt measures for its removal, are known to both. The result of this is, that patients apply for advice when the stone is small, the bladder uninjured by its presence, and the kidneys free from disease. In three out of four persons who apply for advice, for symptoms of *calculus*, the size of the stone and the conditions of the *viscus* render lithotrity an easy and safe operation. Within the last three or four years, I have marked the very early application that patients make for advice, and the small size of the stone when first discovered, compared with those of former years. In private practice, I have not extracted, by either operation, a *calculus* larger than a good-sized mulberry, except in three cases, in one of which the stone was of unusually rapid formation." (p. 13-16.)

"The size of the *calculus*," observes KEY, "forms of itself no objection to lithotrity. A large stone presents, however, several considerations for the Surgeon to weigh before he undertakes the operation. As the stone cannot be entirely crushed at one sitting, a patient with an irritable or unsound bladder, becomes involved in most serious danger by the operation being hastily adopted. A large stone broken up into many irregular fragments, all crowded by the contractions of the bladder against the irritable and inflamed *cervix*, causes excessive efforts to void the urine, and even inflammation of the mucous surface. Under such circumstances, the repetition of the operation becomes impossible, or highly dangerous; and the patient has to struggle through the stages of inflammation, with a bladder irritated by the lesser fragments. But if the bladder be free from disease, and not very irritable, it will bear the number of sittings required to break up a large stone, without much suffering to the patient, and with very little danger. The success of lithotrity, like that of most surgical operations, mainly depends on its subject. If the constitution be good, and the power of endurance great, difficulties of most unpromising nature may be overcome. We should therefore pay more regard to the general condition of the patient, and of his bladder, than to the size of the stones; and inquire minutely into the several circumstances likely to have an influence on the result of the operation. * * * I know of no limits to the size of a *calculus* removable by lithotrity but the power of the lithotrite. If a powerful instrument can be brought to embrace it, and the organ be healthy, the operation may, as far as my experience goes, be attempted with propriety.

"The different ages of patients to be submitted to the lithotrite or the knife, are remarkably contrasted with one another. Whilst to youth and advanced age the latter is more suitable, the former is found generally better adapted to the middle period, between puberty and the decline of life. We have seen, in speaking of lithotomy, that persons whose sexual organs are completely developed, are more liable to the accidents attending the use of the knife than children, whose organs are not yet evolved; or than the aged, whose irritability is on the wane. The full-grown healthy adult, on the contrary, presents all the conditions most favourable for crushing the *calculus*. The canal is sufficiently large to admit an instrument efficient from its size; the prostate gland is usually healthy, and free from the enlargement of age; thus rendering the neck of the bladder a part so important in the operation, little exposed to the dangers of inflammation. When there is a normal prostate gland, the operator may manipulate his instrument without risk of bruising, or otherwise injuring this most sensitive of all the parts concerned in the operation. The *urethra* of such patients being more free, the fragments are expelled with less difficulty, and cause less pain in their expulsion, which is also materially assisted by a sound and vigorous bladder. At this age also, inflammation, should it supervene, is more easily controlled than in the aged subject, who cannot well bear depletion. The warm bath and free venesection, speedily arrest the inflammation of the mucous membrane of the bladder; but the old are soon depressed by the diseased action, as well as by the measures required for its suppression. Inflammation, however, is less liable to occur in such healthy subjects, where the parts are not mechanically injured by the operation, and when the patient has been prepared by dietetic and other prudential measures. The aged subject, however, is not less adapted to the operation than the younger adults, if he be free from the common accidents of age, as an enlarged prostate, accompanied with an irritable state of the bladder. If the parts in the aged are sound, the operation is especially successful in them; as there is less irritability in the organs of generation, and less excitability of the general system. The *urethra* also is usually larger, and if the neck of the bladder be free, it allows fragments of extraordinary size to pass. * * * In the old subject, however, difficulties often present them-

	Age.	Admitted.	Cut.	Cured.	Surgeon.				Remarks.
1830.									
t Wheatler, or ittesley.	66	Jan. 13	Jan. 26	April 15	.	.	Tyrr.	.	
e Birkett . . .	4	Jan. 28	Feb. 5	Mar. 11	.	.	Tyrr.	.	
e Tipper . . . nc., 1829-30; ii.)	55	Mar. 25	April 1	May 13	.	G.	.	.	Nothing particular.
Taylor . . . ıc., 1829-30; ii.)	14	Mar. 25	April 5	Oct. 7	.	G.	.	.	No difficulty in operation, but size of stone not mentioned. Not more than four ounces of blood lost at operation; but an hour after he became pallid, faint, and cold; in evening pulse very small and quick, and very restless; ammonia and opium given, which were soon rejected, but solid opium retained. During night he sunk still more, and on following morning the pulse was scarcely perceptible; countenance cadaverous; thirst extreme; brandy then given, but thrown up, but ammonia with lemon juice retained, and gin every four hours. On *third* day was better, and sickness subsiding; port wine given. On *fourth* day re-action had taken place, and he had great tenderness of the lower part of the belly; castor oil ordered, and repeated in evening, and hot poultices to the belly. In the course of the night the bowels were freely opened, and he was much better on the *fifth* day. The wound was still pale, but the urine flowed freely through it; on each side of the *raphe* a dark purple spot; was allowed a chop and porter and eggs. On *sixth* day had pain in *perinæum*; and on same evening became suddenly faint, the limbs thrown forcibly out, and he appeared dying, but recovered by sprinkling with cold water. On *ninth* day quinine ordered; on *twelfth* day pus discharged from the wound; and on *fifteenth* a considerable slough removed, after which half a pint of pus discharged. From this time he gradually improved.
n Kensley . ıc., 1829-30; ii.)	5	April 6	April 14	June 10	.	G.	.	.	Stone size of filbert; uric acid.
n Saxbee. . . en's book.)	66	May 27	June 4	[*d*]	.	G.	.	.	Moderate-sized stone; superficial perinæal artery tied at operation; wound attacked with erysipelas on tenth day, probably caught from patient near him, which extended to thighs; slough on buttock; cellular tissue on one side of *scrotum* sloughy; no peritonæal inflammation nor other internal mischief.
n Saxbee. . .	59	July 22	July 29	Sept. 9	.	.	Tyrr.	.	
s Dove . . . reen's book.)	4	Aug. 24	Aug. 31	Oct. 7	.	G.	.	.	Stone large.
Mason	14	Oct. 28	Nov. 5	Dec. 23	.	.	Tyrr.	.	Oxalate of lime.
1831.									
eth Cook . . .	9	Jan. 25	Feb. 1	April 14	.	G.	.	.	
Vilkinson . .	21	Feb. 3	Feb. 17	Mar. 24	.	G.	.	.	
ıs Hingeston . een's book.)	4	Feb. 15	Feb. 25	Mar. 14	.	G.	.	.	Small flat stone, uric acid; attacked with *peritonitis* on *sixth* day.
ıs Goodsoul .	56	Feb. 21	Feb. 28	Mar. 21	.	.	Tyrr.	.	
ıs Thorpe . .	32	Nov. 8	Nov. 12	Dec. 18	.	G.	.	.	
1832.									
Stinton . . .	5	Feb. 23	Mar. 2	April 12	.	.	Tyrr.	.	
ıs Brumer . . een's book.)	45	May 2	May 22	July 5	.	G.	.	.	Stone large as crown piece, weighed ʒxiv.; artery of bulb divided, bled freely, and tied at once, but not efficient, and therefore pressure for four hours, effectual.
s Tighe . . .	19	July 2	July 13	Aug. 18	.	.	Tyrr.	.	
Baron	26	Aug. 2	Oct. 26	Nov. 29	.	G.	.	.	
1833.									
d Verle . . .	36	Feb. 28	April 12	[*b*]	.	G.	.	.	
Wheeler . . .	15	June 13	July 5	Aug. 6	.	G.	.	.	
Willis. . . .	63	Sept. 19	Oct. 4	[*c*]	Tr.	.	.	.	
ıs Hannam . .	3	Oct. 2	Oct. 11	Nov. 22	.	G.	.	.	Weight, ʒj. gr. xi. Nucleus, urate of ammonia; the remainder uric acid, with traces of lime.
m Henry Burt	4½	Nov. 19	Dec. 6	Jan. 24, 1834.	.	G.		.	
1834.									
Holden	55	Mar. 14	April 4	[*d*]	.	G.	.	.	Weight, ʒiv. Uric acid, with a nucleus of oxalate of lime.
m Batt	60	Mar. 27	April 4	[*e*]	.	G.	.	.	Weight, ʒiij. gr. xxii.; phosphate of lime.
ick Norman .	.	Aug. 22	.	Sept. 4	.	G.	.	.	

Died. [*a*] June 21, 1830. [*b*] April 13, 1833. [*c*] Nov. 10 [*d*] April 7. [*e*] April 14.

	Age.	Admitted.	Cut.	Cured.	Surgeons.				Remarks.
1834—*continued.*									
William Roderick	12	Oct. 28	Nov. 7	Dec. 18	.	G.	.	.	Stone broken to pie analyzed.
William Thomas	12½	Oct. 30	Nov. 7	Dec. 18	.	G.	.	.	Weight ʒj. ℈ij. gr. cleus uric acid, cov a layer of uric oxalate of lime, crust urate of amn
1835.									
John Symons	14	Jan. 1	Jan. 16	Feb. 19	.	G.	.	.	Weight, ʒij. ℈ij. Oxalate of lime, w of uric acid on the
John Medden	4	Feb. 17	Feb. 27	April 13	.	G.	.	.	
Abraham James	2½	May 22	July 3	Aug. 9	Tr.	.	.	.	
John Wakefield	4	July 21	July 31	Sept. 4	.	G.	.	.	Weight, ʒij. ℈ij. N uric acid, with covering of uric fusible calculus, crust of phosphat with traces of uri
Richard Beet	32	Nov. 25	Dec. 11	April 22, 1836.	.	.	Tyrr.	.	
1836.									
Andrew Martin	5	Dec. 15, 1835.	Jan. 29	Mar. 11	.	G.	.	.	
Thomas Popkins	12	Sept. 17, 1835.	Feb. 12	Mar. 31	.	.	Tyrr.	.	
Joseph Anderson	2½	Mar. 24	April 2	May 11	.	.	Tyrr.	.	
William Garland	4	July 26	Aug.	Sept. 17	.	G.	.	.	
Hazael Weble	4	Aug. 25	Sept. 23	Oct. 25	Tr.	.	.	.	
Robert Weddon	2½	Nov. 2	Dec. 9	Jan. 24, 1837.	.	G.	.	.	
Robert Taunton	10	Nov. 7	Dec. 9	Jan. 24, 1837.	.	G.	.	.	Weight, ʒv. gr. x cleus and next t consisting of o lime; the rema sible calculus.
George Adams	5	Nov. 24	Dec. 9	Mar. 11, 1837.	.	G.	.	.	Weight, ʒij. gr. vii oxide.

These last four years are from the Steward's book.

	Age.	Admitted.	Cut.	Cured.	Surgeons.				Remarks.
1837.									
Felix Aug. Davenport	12	Nov. 8, 1836.	Jan. 20	Feb. 22	.	.	Tyrr.	.	
William Stokes	2	Feb. 21	Feb. 25	[a]	Tr.	.	.	.	
George Lucas	19	Jan. 19	Feb. 3	Mar. 9	.	.	.	South.	Stone weighed ℥iij. pure oxalate of lim with transparent crystals of oxalate of lime; bleeding from perinæal artery soon after and three hours after, soon stopped by pressure.
Henry Peverill	71	June 1	June 24	[b]		.	.	South.	Stone crushed. stone of ʒvij. ℈i
James Row	3	Nov. 22, 1836.	June 2	July 2	.	G.	.	.	Weight, ℈ij. Nuc of ammonia, wi of uric acid hav of lime on its ex
William Perry	2¾	June 26	Sept. 2	Sept. 23	.	G.	.	.	
Henry Turner	2½	Aug. 18	Sept. 2	Sept. 25	.	G.	.	.	
William Sheldrake	57	Aug. 22	Sept. 16	Oct. 24	.	.	.	South.	Stone broke in prostate very l bleeding for s stopped by pre sloughy wound.
John Hawes	4½	Sept. 12	Sept. 30	Oct. 25		G.	.	.	Weight, ʒij. Nuc with traces of lime; next lay of lime; crust lime.
John Pratt	19	Sept. 14	Sept. 30	Oct. 26			.	South.	Free bleeding from perinæal, whicl and from artery internal pudic; pressure seven l

Died. [a] Feb. 26. [b] July 1.

	Age.	Admitted.	Cut.	Cured.	Surgeon.				Remarks.
1838.									
ry Warman. . .	50	Jan. 2	Feb. 10	Mar. 13	.	.	Tyrr.	.	
es Harding . . .	17	Jan. 23	Feb. 10	April 10	.	.	Tyrr.	.	
mas Bull	75	Mar. 14	Mar. 31	May 29	.	.	Tyrr.	.	
iam Brockwell .	4	July 31	Aug. 4	Sept. 1	.	.	Tyrr.	.	
ge Thornton . .	10	July 26	Aug. 18	Sept. 25	.	.	Tyrr.	.	
Slinn	23	Nov. 23	Nov. 30	[a]	.	.	Tyrr.	.	A great gin-drinker; bled in course of the *first* afternoon, but stanched by pressure. Passed no water till four a.m. of *second* day, when the finger passed through wound into the bladder, and the water then flowed freely. Passed clots several times daily till death. Became excessively irritable, but always quieted by gin, which was given freely, but not to the amount it afterwards appeared he had been accustomed to take.
ry Forster . . .	13	Nov. 27	Dec. 15	[b]	.	.	.	South.	Oxalate of lime; pain in belly next day: on seventh day bleeding began, and repeated frequently afterwards. Case given at p. 604.
1839.									
case	.	.	.	.	.	.	.	.	Name and date not known, but is recorded in the Steward's book.
1840.									
h Boston . . .	6	Jan. 7	Jan. 18	Mar. 10	.	.	Tyrr.	.	
s Charman . .	60	Jan. 31	Feb. 22	April 24	G.	.	.	.	Uric acid, and very flat.
rt Crofton . . .	4	April 2	April 11	June 2	.	.	Tyrr.	.	
h Palmer . . .	10	June 9	July 29	Sept. 8	.	.	.	South.	Large oblong stone.
iam Fell	76	July 7	July 18	Aug. 26	G.	.	.	.	Two stones, one ʒvij., other ʒiv. ℈j. gr. xv. Both uric acid.
ard Phillips . .	.	June 23	.	Oct. 10	.	.	Tyrr.	.	Stone crushed.
s Tanner . . .	.	Oct. 26	Nov. 7	Dec. 8	.	.	Tyrr.	.	
1841.									
d Strugnall . .	13	Mar. 17	Mar. 20	May 1	G.	.	.	.	Weight, ʒij. gr. xv. Nucleus, uric acid, with traces of oxalate of lime; the remainder oxalate of lime.
Borer	59	April 13	May 3	June 21	.	.	.	Mack.	Had been lithotritized two years since, but no fragments passed at or after the operation, which was followed by a severe attack of irritative fever, from which he did not recover for several weeks. Though much urged, he would not submit to a second lithotritic operation, on account of the severity of the pain he had suffered. In the present operation for lithotomy, the forceps were withdrawn with some difficulty, containing four seemingly distinct and unequal-sized stones, weighing together ʒxi. gr. xiv., of which the largest exceeded the united bulk of the other three. On careful examination, these were evidently the fragments of one single stone, which they readily formed by properly placing, and had been, doubtless, broken in the lithotritic operation; the broken surfaces had become coated afresh. The stone is uric acid, coated with phosphates.
N. Petrie . . .	4½	May 27	July 1	July 22	.	.	.	Solly	Stone small, and consisting of triple phosphate.
s Lailey	14	June 15	June 22	Aug. 3	.	Tyrr.	.	.	
ard Collier . . .	66	July 29	Aug. 5	Sept. 14	.	Tyrr.	.	.	
y Bowerman. .	12	Sept. 21	Oct. 2	[c]	G.	.	.	.	Nucleus, oxalate of lime covered with uric acid, upon which a layer of phosphate and carbonate of lime mixed; crust of phosphate of lime.
1842.									
d Greaves . . .	18	Sept. 2, 1841.	Mar. 3	April 3	.	Tyrr.	.	.	
Wybrew . . .	8	June 14	July 9	Aug. 13	.	.	.	Mack.	Weight, ʒiv. gr. x.; oxalate of lime thickly coated with phosphates.
ge West	.	July 28	Oct. 1	Nov. 3	.	Tyrr.	.	.	Uric acid.
el Nisbit. . . .	6	Aug. 13	Sept. 17	Oct. 29	.	.	.	B. Tr.	Stone broken to pieces, and not analyzed.
1843.									
d Coventry . .	.	Jan. 14	Feb. 4	Mar. 11	G.	.	.	.	Nucleus of uric acid, next layer oxalate of lime; crust, uric acid.
Will. Langford.	2½	Jan. 24	Feb. 4	Mar. 4	.	.	.	B. Tr.	Uric acid, with traces of fusible calculus.

Died. [a] Dec. 8. [b] Jan. 8, 1839. [c] Oct. 5.

	Age.	Admitted.	Cut.	Cured.	Surgeon.				Remarks.
1843—*continued.*									
James Landon . . .	3½	Jan. 31	Mar. 11	April 15	.	.	Mack.	.	Weight, gr. vj. Impure alate of lime.
Joseph Bishop . . .	62	Feb. 1	Feb. 11	April 27	G.	.	.	.	Nucleus, oxalate of lime: remainder uric acid m with a little oxalate of l
Henry Tabernacle .	34	Aug. 23	Nov. 18	Jan. 9, 1844.	.	.	.	Solly	This patient had been li tritized ten times viously, and was passing large quantities of triple phosphate at the period of the operatio lithotomy, in which two triple phosphate stones were removed.
Joseph Burgess . . .	.	Oct. 30	Nov. 14	Dec. 19	.	.	.	Solly	Stone pyriform, 1½ in long, with four small dules at extremities, and weighed ℥vii. ℈ij. Nucleus of each stone triple phosphate, and remainder composed of layers of oxalate of lime.
1844.									
William Lapworth .	3	Dec. 5, 1843.	Jan. 6	Feb. 6	G.	.	.	.	Stone, size of kidney b uric acid.
William Evenden .	74	Dec. 23, 1843.	Jan. 8	Mar. 26	.	.	.	Solly	Two stones, one size of a nut, the other a t smaller; both consisting of uric acid. Much venous bleeding, which was not checked for hours and a half.
William Sparkes . .	47	April 6	.	[a]	.	.	.	Solly	Extensive ulceration of neys. Large nucleu animal matter, seemingly a clot of blood; the stone composed of uric acid and oxalate of li
George Sawyer . . .	12	July 11	July 27	Nov. 10	.		Mack.	.	
John Snooks	6	Aug. 20	Sept. 16	Oct. 22	.	.	Mack.	.	Weight, gr. xlvii.; consi of urate of ammonia, a trace of urate of lime
John Easton	12	Aug. 20	Oct. 5	Dec. 3	.	.	.	Clark	Oxalate of lime.
1845.									
Henry Smith	4½	May 6	May 30	July 18	.	.	Mack.	.	Nucleus, uric acid; remai oxalate of lime mixed uric acid.
Nathan Robins . . .	11	Sept. 9	.	[b]	.	South.	.	.	Nucleus, oxalate of li next layer, uric acid, traces of fusible calculus covered with oxalate of lime; the crust, fusible calculus and uric mixed. Scarlet fever appeared on the fifth day. After death it was found his family infected when he left home.

Died. [a] April 18. [b] Oct 20.

[The analyses of the greater number of the above stones are by Dr. Leeson, and copied from St. Thomas's Museum Catalogue. Those of Lucas, Borer, Wybrew, Landon, and Snooks are by my friend Thomas Taylor. I should be much obliged by any St. Thomas's pupil communicating to me notes of any cases of stone which he possesses, of which I have been unable to obtain particulars: more especially of those in the early part of this table, so as to render it more complete.—J. F. S.]

[OF LITHECTASY.

Lithectasy, or *Cystectasy*, which has been, within the last few years, warmly advocated by Dr. Willis (*a*), has for its object the removal of stones from the bladder, without division of its neck. The operation consists in opening the *urethra*, in the *perinæum*, behind the bulb of the *penis*, to the extent of a few lines, and then slowly dilating the membranous and prostatic portions of that canal, and the neck of the bladder. How far this mode of treatment will succeed has yet to be tested by experience; but I am disposed, with Fergusson, to believe, that the neck of the bladder would not be so surely uninjured by the dilatation as is presumed.

The original proposer of this method appears to have been John Douglas (*b*), who seems to have been led to it by having noticed the passage of small stones through the fistulous canals, left after the operation with the great apparatus, as performed by

(*a*) On the Treatment of Stone in the Bladder by medical and mechanical means. London, 1842. 8vo.

(*b*) Two Chirurgical Questions stated and answered; in Phil. Transactions, vol. xxxiv. p. 318. 1726, 27.

Mariana, and already mentioned, (p. 571,) and also by the natural escape of stones through the dilatation of the short *urethra* of women. He, therefore, proposed the establishment of a perinæal fistula, so that, as near as might be, the opportunity for the escape of a stone from the male bladder, should be similar to that from the female bladder, in both cases requiring little more than the dilatation of the neck of the bladder. He then put the question, "Whether it be not possible to dilate the artificial fistula in the *perinæum* of males, and the *urethra* in females, with sponge or gentian tents, gradually increased for some time to such a width that we may easily pass a pair of forceps into the bladder, with which the stone, when small, may be extracted, and when large or of an irregular figure, broke, and the pieces extracted gradually, and at different times, when they cannot be extracted at once, without fatiguing the patient too much," (p. 320,) and after discussing the subject, he concludes:—"Therefore, artificial fistulas in males, and the *urethra* in females, may be dilated so as to extract any stone, without cutting the body of the bladder, or lacerating any of the parts." (p. 322.) It does not appear, though Douglas proposed, that he ever practised this method, and like many other proposals, it was lost sight sight of for many years; still, however, it is his operation, though Dr. N. Arnott (*a*) says, "that the means proposed by Douglas are inadequate" for its performance; forgetting however to mention that Douglas had honestly referred to a case of Collet's (*b*), in which a perinæal fistula after lithotomy had been successfully dilated with sponge tent, as in Douglas's proposed operation.

In 1819, however, Collet's plan was suggested and practised by Dr. Arnott (*c*), in a case under the care of Astley Cooper, for a recto-vesical fistula of nine months' standing, after an unsuccessful operation for the stone, in which the *rectum* had been wounded, and the stone left in the bladder. For the relief of this fistula, Astley Cooper made an opening into the *urethra*, from the *perinæum*, and introducing a female catheter, immediately struck a stone. This not being expected to be large, Astley Cooper yielded to Arnott's proposal of dilating the passage from the *perinæum* into the bladder with his fluid-dilator instead of sponge tent; after the employment of which, for thirty hours, the passage from the *perinæum* to the bladder was enlarged to three-quarters of an inch in diameter, and Cooper then introduced a pair of stone-forceps, and extracted a stone as large as a moderate-sized walnut.

Stimulated by Willis's enthusiastic expectations, Elliott of Carlisle (*d*) performed this operation in July, 1842, on a lad of seventeen, with the variation of making the wound larger than recommended by Willis. "The different steps in the operation were precisely the same as in lithotomy, until the prostate and membranous part of the *urethra* were exposed. The latter was opened close to the prostate, and divided cautiously towards the bulb by carrying the knife along the groove of the staff till an opening was made of sufficient size. The staff was then withdrawn, and the point of the forefinger of the left hand served as a guide for the introduction of the dilator, which, having been previously well greased, was passed along without difficulty. A little warm gum mucilage was next slowly injected into the instrument, until the patient slightly complained of the feeling of distension. On removing him from the table to the bed he complained of a strong inclination to make water, which was found to arise from the dilating part of the instrument having slipped into the bladder. It was emptied, partially withdrawn, and, when fairly within the neck of the bladder, again distended. Another opiate was given, one having been given before the operation. In three hours' time a few teaspoonfuls of the mucilage were again thrown into the dilator till the patient complained. The urine had passed freely along that part of the tube which communicated with the bladder." He went on well; no further injection was made; but in the middle of the following day he was a little uneasy, and another opiate was given. At the end of twenty-five hours Elliott "emptied the dilator and withdrew it, at the same time passing his left forefinger along it into the bladder. He immediately felt the stone, which was of small size, and in shape resembled a coffee bean, but about four times its size. It was removed with the scoop and finger," (p. 137,) and a lithotomy-tube introduced. In his remarks on the case, Elliott advises the dilatation "being done at intervals, for, say a quarter of an hour at a time, as less likely to cause irritation than if continued for a period of thirty or forty hours, as has been mentioned." (p. 139.)

Dr. Wright, of Malton, Yorkshire (*e*), performed the second lithectasy on a man of sixty, in the autumn of the same year, and made "an opening a few lines in extent into the membranous part of the *urethra*," but could not introduce the dilator, evidently

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(*a*) Lancet, 1842–43; vol. ii. p. 612.

(*b*) Traité de la Taille.

(*c*) Essay on the different modes of extracting Stone from the Bladder, by James Arnott. London, 1821. 8vo.

(*d*) Edinburgh Medical and Surgical Journal, vol. lix. p. 135.

(*e*) London Medical Gazette, vol. xxxiv. p. 77. 1843–44.

for want of room; attempts were made to enlarge the passage sufficiently with bougies for its admission, but it could be only imperfectly got in, and was left without distending it till three days after, when the injection escaped, the bladder-part of the instrument having rotted. Another instrument was then passed with difficulty, but the patient could not bear the distension, and during the following weeks suffered much constitutional excitement. Not till the eighth day after introducing the second instrument could any progress be made with the distension, but then it went on rapidly, and on the eleventh, "the *urethra* having been dilated to as great an extent as the instrument would allow, an effort was made to extract the stone. It was seized with the lithotomy forceps, but it was discovered to be too large to remove entire without using more violence than was thought prudent or safe." (p. 79.) The stone was, therefore, broken up with Fergusson's lithotrite, and brought away piece-meal; it weighed a little short of two ounces troy." (p. 78.) The patient did well. Wright inquires, "Would it not be better to make the incision in front of or anterior to the bulb, where the canal is so superficial that it could be opened by a mere scratch? It certainly requires no formidable incision to reach the membranous portion: still it must be of some depth, and it occurs to me as just possible that on introducing the dilator, its extremity might be carried past the opening in the *urethra* into the surrounding cellular tissue. I imagine the bulbous portion would be dilated as easily as the membranous part of the *urethra*." (p. 79.)

In June 1843, Fergusson (*a*) performed the third lithectasy in a man of sixty-four, who had suffered very severely, and for five years had been continually passing stones as large as peas. The urethra was opened by "an incision along the *raphe* about one inch and a half in length, terminating about half an inch in front of the *anus*, from which point two incisions, each about three-fourths of an inch in length, were carried downwards and outwards. The superficial cellular tissue being divided to a similar extent, the point of a knife (a common lithotomy bistoury) was thrust into the groove of the staff a little in front of the triangular ligament. The edge of the blade was so applied as to divide the triangular ligament to a slight extent, first downwards and outwards on one side, and then in a similar way on the other; the groove of the staff being then distinctly felt by the forefinger of the left hand, the metal point of an Arnott's dilator was placed within it, and slid cautiously into the bladder. The staff was next withdrawn, and the bag of the dilator was partially distended with a solution of gum arabic, the distension having been continued until the patient complained of pain." Additional quantities of fluid were repeatedly thrown in for the first two hours; again, at the third, and at the end of the fourth, the instrument being fully distended, was withdrawn, and another larger one having a passage through it for the escape of the urine, was introduced. At the ninth hour, a larger instrument was passed, and directed to be distended as the patient could bear it. At the twentieth hour, this dilator, an inch and a quarter in diameter, having been fully distended, was removed, and the stone attempted to be removed with the scoop several times unsuccessfully, as it brought away only fragments. Forceps were also used, but the stone was too large to pass, and was therefore broken by forcibly closing the blades; the pieces were readily removed. Constitutional excitement, however, came on, and he died on the evening of the sixth day. On examination, the principal circumstance was that "the cellular tissue between the bladder and *rectum*, and that lying on the outer surface of the gut was softened, and slightly infiltrated with a sero-purulent fluid." (p. 576.) It would seem from Fergusson's observations, that he thought the distension had been made too quickly; for he says:— "Unless the dilating process were effected in a much slower manner than was recommended for lithectasy, he feared that the mucous membrane and *urethra* would not only be dilated, but actually torn." (p. 577.) And further, that "it was one of the main objects in lithectasy to avoid any wound of the neck of the bladder; but he doubted if this could be avoided, and a certain amount of inflammation might, therefore, be calculated upon." * * * On any future occasion, he should suggest that a longer period should be expended in using the dilator, and also that in the event of the stone proving too large for ready removal, the lithotrite should at once be used. * * * It was his opinion that in such an operation there would always be greater difficulty in extracting a stone of any considerable size than in lithotomy; for in the latter case the wound extended down alongside of the *anus*, and the forceps holding the stone could be more readily depressed, whilst in the former, (lithectasy,) the manœuvres were conducted near the angle of the *pubes*, and consequently in the narrowest part of the space between the bones, a space which the experienced lithotomist was always careful to avoid." (p. 578.)]

(*a*) London Medical Gazette, vol. xxxiv. p. 77. 1843-44.

FIFTH DIVISION.

OF DISEASES WHICH CONSIST IN THE DEGENERATION OF ORGANIC PARTS, OR IN THE PRODUCTION OF NEW STRUCTURES.

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————; in R. WAGNER's Handwörterbuch der Physiologie mit Rucksicht auf physiologische Pathologie, Art. *Gewebe* (in pathologischer Hinsicht.)

2147. The two classes of disease to be considered in the present section, to wit, the degeneration of organic parts and the production of new structures, agree together so far as a general character of the degeneration of organic parts, is, that the enlargement of the surrounding parts depends not merely on the increased deposits into them of the matters forming them in their natural state, but that in the parenchyma of the part, more or less, of such matter foreign to their natural structure, is produced and deposited; hence is it often very difficult to determine, whether a diseased structure is to be attributed to the change of the organ, or to a new formation.

[LAWRENCE has well observed:—" It is not easy to draw a clear distinction between new or accidental productions and changes of structure, or degenerations of organs. There is no definite boundary between them; on the contrary, as in other diseases, there is an insensible transition from one to the other. In the case of *Fungus hæmatodes*, we find the same structure sometimes occurring as a new production, an independent tumour; sometimes as a change of structure in a part. Indeed, we meet with this growth in three distinct forms; viz., as a deposit enclosed in a cyst, as an unencysted formation, and as an infiltration in the substance of an organ. Again, we find a similar gradual transition between the structures composing various kinds of tumour, so that we often hesitate in deciding to which species a particular swelling should be referred. As the same gradual blending of one form into another occurs throughout the whole field of disease, we cannot wonder that the several attempts at reducing its infinitely diversified phænomena to an artificial arrangement of classes, orders, genera, species and varieties should have failed." (p. 4.)]

2148. All degenerations of organic parts appear to have their origin in a local increased vascular activity, on which depends the deposit of a substance more or less resembling the elementary parts of the organ, or of a peculiar substance, in the interstices of the part, in which by the shooting forth of the vessels, and their very extensive ramifications, the unnatural formative disposition is sustained, and the growth of the tumour increased. We find, therefore, also in most cases, that although there be no characteristic signs of inflammation, yet that increase of temperature, peculiar sensibility on pressure, tension, and the like accompany the beginning of degeneration. In most cases, the increase of vascular activity is not to be distinguished by the symptoms which characterize it; for little as we can comprehend the natural growth and development of organs without increased activity of the vital processes, just so little can we understand it in diseased structures. Development of vessels, diseased secretion, continued production of the secreted matter, with growth of vessels in it are the processes, which in the course of these diseased formations are constantly repeated. The unnatural commixture and condition of the juices, and the large quantity of inorganizable matter may indeed effect the separation of peculiar substances, distend, increase, and change the tissue of different organs; but special degeneration with self-active production, proceeds only with increased development, and multiplication of vessels. Secreted inorganizable matter remains either in that state, or hardens, and then first operates on the surrounding parts, but always remains without vascular connexions, and is destroyed in a purely chemical manner, as the history of the formation of tubercles shows, although even they may be converted from the formless condition into cells.

2149. In the diseased changes of organic parts, either the vessels, arteries, capillaries or veins, often the one more than the other, are specially developed, or the uninjectable part of the cellular tissue is specially prevalent by the deposit of formless matter, or both exist at the same time in different proportions. If these conversions depend only on quantitatively changed nourishment, they can increase to an enormous extent, without otherwise than mechanically operating destructively; they support themselves like the natural tissues, and participate in the general change of matter. But if there be at the same time a qualitative change of the nutritive matter, if they depend on general *diathesis*, and alteration of the formative disposition, they have a specific character, are accompanied with reaction of the whole organism, and draw all the tissues without distinction of their organisation, into the same diseased change; they cannot retain their development unchanged in the highest degree, but according to their nature are destroyed and pass into softening. Hence arises the division into *benignant* and *malignant* tumours.

2150. The after-products, which must be considered as new formations, are either repetitions of natural formations, as the adipose and encysted tumours, and the like; or they are formed from substances foreign to the natural composition of organic parts, as, for example, medullary *fungus.* They are vegetative formations, which simply by their further growth, compress the neighbouring parts, do not convert them into the same mass, for instance, adipose tumours, cysts, polyps, and the like; they are inconvenient, therefore, only by their size. But others possess the above-described specific characters, consequently have a fatal reaction on the whole body, and draw the neighbouring tissues into the same diseased change.

Diseased growths are subject to the same general laws as are the origin and development of the natural tissues. According to the results of microscopic observation, two theories have been put forth on this subject, to wit, the cellular theory and the corpuscular theory.

According to the *cellular theory*, there is every where at first a simple formative matter, *cytoblastema*, in which are formed nuclear cells, *cytoblasts*, and in them cells are produced; or the nuclear cell is formed first, and the cell walls are formed secondarily around it. In many cells the pathologic tissue is perfected with the complete development of the cell. In general these first-formed (primary) cells undergo still further changes, and from them are produced elementary parts, which exhibit no more of the original cellular form. It is usually then the cell-walls which pass into the remaining parts of the organism, more rarely do the nuclear cells undergo a still further development, and still more rarely do organic pathologic tissues arise, the development of which can never be traced to a cellular formation. It is highly probable that the nature of the subsequently produced tissue does not depend on the nature of the cytoblast, but upon the subsequent accession of external influences.

According to the *corpuscular theory*, the formative corpuscles are produced in the plastic matter by clotting together. In the midst of this matter, consisting of granules and formless matter, a formative corpuscle arises, and a *nucleus*, composed of a homogeneous tough matter, which continues increasing, so that at last there remains only a thin peripheric layer, which also becomes changed. In this *nucleus* a great quantity of molecular corpuscles are formed. The corpuscle then drops in on either side, and the middle protrudes, so that it resembles a knife-like body, and passes into the form of hæmatoids, or ring-shaped bodies, a *nucleus* with a ring. Of the formative as well of the hæmatoid bodies, one part lies unconnected with the rest and movable; this is the blood corpuscle; the other part is connected by contiguous linear ranks, by layers of plates and heaps of corpuscles, and forms the tissue (*a*).

2151. The tumours produced by those unnatural formations, which are not to be considered as repetitions of natural parts, belong to the most difficult subjects of the healing art; they may be considered in reference to their origin, their further development, or to their manifold differences, for the purpose of grounding thereon their classification. In former times the various swellings of this kind were spoken of under the general designations, *scirrhus*, *carcinoma*, *steatoma*, and the rest. More careful inquiry has, however, recently showed remarkable differences in the nature of the diseasedly-produced substances which form these tumours, and upon these it has been attempted to class them.

2152. ABERNETHY points out five peculiar kinds of tumours, to wit, the *pancreatic*, *mammary*, *pulpy* or *medullary*, *tuberculated* and *carcino-*

(*a*) VOGEL, above cited.—BAUMGAERTNER, Lehre von den Gegensätzen in den Kräften im lebenden thierischen Körper ein Grundriss zur Physiologie und allgem. Pathologie und Therapie, p. 32. Stuttgardt, 1842. Second Edition.—ARNOLD holds the same views as BAUMGAERTNER.

matous Sarcoma. Laennec admits a fourfold variety of the tissue in which these tumours are formed, namely, the *tuberculous*, *scirrhous*, *cerebriform*, and *melanosis.* Meckel considering Laennec's *melanosis* the same as Abernethy's tuberculated and medullary sarcoma, points out six different tissues, the *pancreatic*, the *mammilloid*, the *cerebriform* or *medullary*, the *scirrhous*, and the *tuberculous* or *scrofulous.*

2153. John Müller (*a*) has very recently endeavoured, from microscopico-chemical observations, to found a division of tumours, according to their *chemical nature*, their *microscopic structure*, and the manner of their *development.* In reference to their chemical composition, all tumours are, according to the elementary parts of which they consist, either *fatty tumours*, *jelly-yielding* (*b*), or *albuminous* tumours; other substances, as osmazome, *saliva*, caseine, and so forth, may indeed be present in them, but only in small quantity proportionally to the principal elementary parts. The more minute microscopic elements of tumours are, besides capillary vessels, fibres, granules, cells without and with *nuclei*, tailed or spindle-shaped corpuscles, vessels, and by far the most common element is cells. The principle of dividing tumours into groups can be obtained neither merely from their minute structure nor their chemical nature; for tumours the most differing in reference to their physiological nature and curability, may equally possess the most delicate structure; in similar structures chemical differences may exist; with similar chemical nature, there may be difference of structure, or difference in respect of physiological peculiarities and curability. In the formation of groups these several points must be taken into consideration.

2154. These various opinions serve to prove how difficult it is to make an accurate and sufficient division of tumours dependent on their unnatural structure. The ground of this difficulty rests, without doubt, on the manifold changes to which the diseased matter is subject in the various periods of the development of the tumour; further, on the undistinguishable influence which the natural structure of an organ has upon the after-formation developed in it, and on the variety of causes upon which it depends. There are, therefore, tumours, in which are present, at the same time, several of these diseased products, either lying near to, or intimately connected with each other. But if pathological anatomy be of direct use and immediate application to practical medicine, it must not rest on the mere examination of the changes of organic parts and of the substances forming the tumour, and assume these alone as the ground of division; but it must at the same time consider the symptoms, course, and effect upon the immediate neighbourhood, and the whole body, if it would not be seduced, by incorrect particulars, into subdividing similar diseased conditions. Under this supposition, the number of tumours founded on the above mentioned variety of diseased tissue, may be conveniently referred to three, namely, *medullary fungus*, *scirrhus*, and *tubercle*, in which case the pancreatic and mammary tissues are to be considered merely as accidental modifications of the medullary (*c*).

2155. These unnatural structures, completely foreign to the natural composition of the organism, may agree in general with each other; they consist, probably, or for the most part, of *albumen*; their tissue is more

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(*a*) Above cited.

(*b*) This is a well-chosen designation, as it is shown by Thenard that "gelatin does not exist in the humours of animals; but all their soft and solid parts contain the materials proper to its production." Traité de Chimie, vol. iv. p. 379. 1827. Fifth Edition.

(*c*) Walther, above cited.

or less distinctly cellular; they contain a fluid of various consistence, and enclosed in differently-shaped cells; at first they are harder than in the subsequent periods of their development, and then are for the most part harder than the organs in which they are met with, in which case they soften, and are converted into a fluid, or into a substance of looser texture. Their form is for the most part more or less round; they strive to destroy the neighbouring parts, and the organism which are drawn into the same diseased structure, or displaced by pressure, and further propagate the diseased affection by the lymphatic vessels, and perhaps also in other ways.

I.—OF ENLARGEMENT OF THE TONGUE.

(*Prolapsus Linguæ, Macroglossa*, Lat.; *Vorfall der Zunge*, Germ.; *Hypertrophie de la Langue*, Fr.)

Clanny, W. R., M.D.; in Edinburgh Medical and Surgical Journal, vol. i. p. 317. 1805.

von Siebold, C., Beobachtung über die Verkürzung widernatürlich zu grosser Zunge; in Chiron, vol. i. p. 651.

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Percy, Article *Langue* (Pathologie Chirurgicale); in Dict. des Sciences Médicales, vol. xvii. p. 244.

Mirault; in Mémoires de la Société de Médecine de Montpellier, 1816, part iv. p. 517.

van Doeveren, H. H., Dissert. de Macroglossa, seu Linguæ enormitate. Lugd. Batav., 1824; cum tabulis duobus. 8vo.

2156. If the tongue increase very much in bulk it protrudes over the jaw, and can only be brought back into the mouth with difficulty, or not at all. This evil is generally congenital; but the enlargement of the tongue is not at first considerable. Its fore part appears only between the lips, it projects in a mass as it enlarges over the lower lip and jaw, and causes great deformity. By the hanging down of the fore part of the tongue the swelling becomes larger, the tongue-bone and *larynx* are drawn forwards; there is great difficulty in swallowing, the spittle flows out, and from the constant dryness of the throat, swallowing becomes still more difficult. The articulation of the voice is greatly hindered; and when the disease has long continued, the muscles of the tongue are in a palsied state. By the continued position of the tongue between the jaws the circulation is stopped in the protruded part, the tongue swells more considerably, and presses the teeth and the alveolar process of the lower jaw outwards; by the constant rubbing of the tongue indentations and excoriations are produced; the constant exposure of the protruded part to the air causes clefts and chinks, and often deep ulcerations; and the *papillæ* become unnaturally thick and prominent.

2157. The enlargement of the tongue takes place either a shorter or a longer time after birth, or after cutting the second set of teeth, and is frequently preceded by convulsions, and its cause seems to be palsy of the muscles of the tongue. In such cases the incisive and cuspid teeth are not pushed forwards, but are rendered useless, and fall out by the constant rubbing of the tongue (*a*).

The enlargement of the tongue above mentioned must be distinguished from that protrusion which depends on inflammatory swelling, and from tumours of various kinds developed in the tongue.

(*a*) Boyer, Traité des Maladies Chirurgicales et des Opérations qui leur conviennent, vol. vi. p. 385.

2158. The congenital lengthening of the tongue is of no great consequence; it is easily relieved if recent, and not incurable even when it have existed longer. The above-described symptoms accompanying this complaint when severe, especially its ill effects on nutrition, partly in regard to the difficulty of swallowing, and partly on account of the continued loss of the *saliva*, render its early treatment necessary.

2159. The *treatment* varies according as the disease is congenital, or as it has occurred after birth; and in the former case, with reference to the length of time it has existed. Soon after birth it is generally sufficient to prevent the complaint increasing, to irritate that part of the tongue protruded between the lips with acrid powders, as pepper and the like, in order to induce the child to draw it back. If it be necessary to keep the tongue in the mouth, a bandage must be applied to keep the lower against the upper jaw. As the enlargement of the tongue is encouraged by sucking, a wet-nurse must be chosen whose nipple is large and long, so that the tongue may require less lengthening as the child sucks than with a short nipple, or the child must be fed with a pap-boat. In the interval, when the child is not sucking, it must be endeavoured to prevent the protrusion of the tongue by the means already directed.

[CLANNY (*a*) mentions the case of a boy five years old, on whom the tongue had begun to protrude within the first year, and at the former age had projected three inches; but was returned with difficulty, and the jaws kept together, as recommended by LASSUS (*b*). The tongue was replaced in the mouth with much difficulty, and retained by keeping the jaws perfectly closed with a handkerchief passed round them, and over the crown of the head, for the period of five weeks.]

2160. If the enlargement of the tongue be so considerable that it cannot at once be brought back into the mouth, its size may often be gradually diminished by repeated application of astringent irritating remedies. Scarifications and leeches may, with this view, be useful, as well as moderate and gradually-increasing pressure, by means of a roller or a little bag of linen. This compression of the tongue, in which the bandage must be frequently moistened with a stringent, and the patient kept on his back, is advantageous, if properly persevered in, oftentimes in very far advanced cases. When the tongue has been so far reduced that it can be brought back into the mouth, the jaws must be kept constantly closed by means of a bandage. If the surface of the tongue be dry, it must be moistened by frequent washing and fomentation (*c*).

2161. When the enlargement of the tongue is so considerable that no benefit is attained by the above treatment, and when by the long continuance of the disease its fore part is changed in structure, there remains nothing but *shortening its length with the knife*, *or with a ligature.*

2162. The patient, seated on a chair, must have his head fixed by an assistant standing behind him, and his mouth kept open either with a cork inserted between his back teeth, or by means of a *speculum oris*. The patient then protrudes and retracts his tongue, so that the operator may decide how much shall be removed. The tongue being protruded, is held by an assistant obliquely upwards with a pair of *polypus* or curved *œsophagus* forceps. The operator then grasps the front of the tongue with his fingers, or fixes it with a hook, and with a strong bistoury cuts off some lines of the tongue in a semilunar shape, at a stroke. The forceps serve

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(*a*) Above cited, p. 317.

(*b*) Mém. de l'Instit. National, vol. i. p. 1, an vi.; and in Medical and Physical Journal, vol. vi. p. 353. 1801.

(*c*) BOYER, above cited, p. 387.

as a tourniquet, and the bleeding is stanched either by ligature, by the actual cautery, or by pressure and styptics.

Where the state of the tongue permits, it is best, according to Percy (*a*), to cut out, by two strokes of the knife, a Λ shaped piece, with its point backwards, and after stanching the bleeding to bring the wound together with the interrupted suture. If, after the operation, the lower incisive teeth project considerably, attempts must be made, by continued pressure, to put them back; and if this should be unsuccessful, they must be drawn. If the lower lip continue everted and much outspread, so that the spittle cannot be retained, a triangular piece must be cut out as in the operation for cancer of the lip, and the wound healed by the twisted suture (Mirault.) The application of a ligature for the removal of part of the tongue, in which the ligature is at once tied round it, or for the purpose of hastening its cutting through, a double thread is passed with a needle into the tongue, and the ends tied on each side, and gradually tightened, till the tied part dies, is attended with greater pain, and is more tedious than cutting it off with the knife, but is more safe against bleeding.

[Harris (*b*) of Philadelphia tried to remove a portion of enlarged tongue, by introducing with a needle a double iron wire through the middle of the tongue, and having separated the two portions of wire, he brought them across the tongue, passed the two ends of each through a corresponding double canula on each side, and then twisted them; the circulation ceased, but only for two hours. He then passed a strong silk ligature, and fastened it in the same way; but in forty-eight hours the circulation had returned. He therefore amputated the tongue with a catlin, through the track made by the ligature; the two principal arteries were tied at once, and other three, which had been allowed to bleed, to diminish the irritation caused by the previous ligatures, were taken up afterwards. The wound was dressed with dry lint, and the patient recovered perfectly, with the exception of a slight lisp in her speech. Harris, therefore, strongly recommends amputation, in preference to the ligature.]

2163. The protrusion of the tongue dependent on paralysis of its muscles, requires, besides the constant retraction of the tongue, blisters behind the ears, and on the neck, the application of irritants, of electricity, galvanism, and the like.

II.—OF BRONCHOCELE.

(*Bronchocele*, *Struma*, Lat.; *Kropf*, Germ.; *Goître*, Fr.)

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Gautieri, Tyroliensium, Corynthiorum Styriprumque Struma. Viennæ, 1794.

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(*a*) Above cited.

(*b*) American Journal of Medical Sciences, vol. vii. p. 1. 1830.

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WILMER, B., Cases and Observations in Surgery, with a Method of curing Bronchocele in Coventry. London, 1779. 8vo.

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M'CLELLAN, Inquiry into the Nature and Causes of Goître, from a work on the Geology of Kemaon, Calcutta, 1835; and republished in Dublin Journal of Medical Science, vol. xi. p. 295. 1837.

INGLIS, JAMES, M.D., A Treatise on English Bronchocele, with a few Remarks on the Use of Iodine and its Compounds. London, 1838. 8vo.

COPLAND, JAMES, M.D., Article *Bronchocele;* in his Dictionary of Practical Medicine, vol. i. p. 269.

2164. *Bronchocele* is a chronic, painless, more quickly or slowly arising swelling on the fore and under part of the neck, depending on enlargement of the thyroid gland, and varying considerably in reference to its extent, form, and hardness. The swelling begins in one or other lobe, or affects the whole gland, and may attain an enormous size; in most cases it has a pendulous shape. At first the skin is unchanged; as the growth increases, the veins in the neck and on the tumour swell and become varicose. If continuing still longer, the swelling usually feels elastic, soft, and regular; but after a further time, becomes firmer, and in some parts quite hard and uneven. Sometimes the swelling is so firmly connected with the neighbouring parts, that it is little or not at all movable. If left alone, the bronchocele continues increasing; but in rare cases runs on to inflammation or suppuration, by which it diminishes, or entirely disappears.

By the above description of bronchocele, its distinction into *true* and *false*, by which latter term various swellings in other parts of the neck have been described, is got rid of.

2165. So long as the bronchocele is not large, it causes little or no inconvenience; but with its increasing size, the voice gradually becomes hoarser, the swallowing and breathing difficult, and there are severe fits of coughing. These symptoms increase in correspondence with the greater enlargement of the swelling, till there is danger of suffocation; in consequence of the obstructed circulation in the vessels of the neck, the blood collects in the vessels of the head; the face becomes puffy and bluish, the patient complains of headache, and apoplectic symptoms may ensue. Owing to the disturbed breathing, and the less expansion of the chest, the circulation through the lungs is interfered with, the obstacle which the arteries suffer to the impulse of blood given by the heart is increased, the cavities of the heart expand, and their walls thin; and hence arises the frequent enlargement of the heart observed in bronchocele (*a*).

2166. Various kinds of bronchocele must be distinguished according to the variety of degeneration of the thyroid gland, which accompany its enlargement, namely, the *vascular*, the *lymphatic*, and the *scirrhous bronchocele.* The designation of an inflammatory swelling of the thyroid gland, (*Cynanche thyreoidea,*) as *inflammatory bronchocele*, is improper.

(*a*) LULLIER.—WINSLOW; in Journal général de Médecine, vol. lvii. p. 414. 1816.

Inflammation of the thyroid gland, which may be caused by cold, external violence, and the like, produces, on account of its quickly-arising swelling, considerable difficulty in breathing and swallowing, determination to the head, rushing in the ears, disposition to bleeding from the nose, and the like, and is usually accompanied with fever. If it run on to suppuration, the abscess does not protrude much, and the collection of pus, with increase of the above inconveniences, may become very considerable.

The *treatment* of inflamed thyroid gland requires blood-letting, leeches in great number on the sides of the neck, calomel, and the like. If an abscess form, it must be opened as soon as the presence of pus is ascertained.

2167. In *Vascular* or *Aneurysmatic Bronchocele* (*Struma vasculosa, aneurysmatica*) the vessels of the thyroid gland, arteries, veins, and capillary vessels, which, with cellular tissue, make up the greater part of its parenchyma, become considerably enlarged. This kind of bronchocele is characterized by its sudden origin, its quick growth, and large size. The swelling is warm, firm, and tense; the patient feels in it a violent beating, sometimes a roaring. If the hand be applied, the beating of the arteries is felt at some one part of its external surface, but especially in the course of the large arteries in the substance of the gland; even the superficial twigs and branches are so much enlarged that they are seen through the general coverings, and their pulsation is distinctly perceptible. The superior thyroideal artery, before it enters the substance of the gland, is felt beating violently, if the gland be not so very much enlarged that it cover this artery and spread over it with its upper outer lobe. Vascular bronchocele produces, earlier than any other, difficulty of breathing and swallowing, frequent bleeding from the nose, dizziness, and determination to the head; it constantly increases.

2168. *Lymphatic Bronchocele* (*Struma lymphatica*) is of most frequent occurrence, and in many places endemic. The cells in the parenchyma of the thyroid gland become filled with a clammy transparent fluid, sometimes with a viscid, brown mucous substance, sometimes with a lardy or cheesy mass, and sometimes with concretions and bony knobs. The walls of these cells thicken, often exceedingly, even to a cartilaginous consistence, become united with the masses collected in them, so that the cells are more or less completely destroyed, and the whole gland is converted into a shapeless mass. The vessels may, indeed, here also be enlarged, though not to the same degree as in vascular bronchocele. Lymphatic bronchocele increases more gradually, and feels more knobby.

From this general sketch lymphatic bronchocele exhibits itself under as many forms, in reference to its external appearance, as it can present. Sometimes it shows a perfectly homogeneous, tolerable firm substance, without any yielding part, and resembles a sarcomatous degeneration. Sometimes its surface is irregular, several large knobs are produced, hard, in several parts cartilaginous or bony. Sometimes particular cells enlarge, so that the greater part of the bronchocele consists of one or several cysts, the walls of which are more or less thickened and filled with fluid of different colour and consistence.

This form of bronchocele was known to the ancients, (Celsus,) was described by Albucasis as *Bronchocele aquosa*, was variously noticed by Helwig, Heister, and Ploucquet, and has been fully described by Maunoir (*a*) as *Hydrocele Colli*. Percy would have it named *Hydro-Bronchocele*, and Beck (*b*) has described it as *Struma cystica*.

The swelling developes itself on the fore part of the neck, on one or other side, sometimes on both at once, in which case there are often two lobes, with a considerable depression in the mesial line. It generally affords distinct fluctuation at every part, is opaque, but sometimes so transparent that the cysts and fluid contained in the deep-lying blood-vessels can be distinguished through the coverings (Pelletan.) Its size

(*a*) Mémoires sur les Amputations, p. 93. Genève, 1825.

(*b*) Ueber den Kropf. Freiburg, 1833.

is very various, and it may become so large that the breathing may be rendered very difficult or completely stopped. Its cavities are frequently divided by a partition which is open at some one part, so that the two sides of the swelling communicate with each other. The cysts, which are almost always very thick, resistant, and little contractile, usually contain a brownish-coloured fluid; the other parts are very different.

Opinions vary as to the actual seat of the swelling. Some say it is developed at the expense of the thyroid gland; others in the tissue surrounding the gland, in which case the gland, pressed back towards the windpipe, becomes atrophic, and is more or less surrounded with a false membrane, and the cyst is placed at its hinder upper part. If the swelling be developed in the gland itself, there are very rarely found any traces of its *parenchyma*, the vessels alone remain, and are filled with fluid which has usually the colour of wine lees. That the thyroid gland usually remains sound in this disease, as has been also supposed, appears without foundation; and according to the above-described, ordinary relations of the gland, its determination as a peculiar kind of lymphatic bronchocele is legitimate. It is characterized by its egg-shaped or globe-like form, without knobby elevations, by the elastic tension of the most projecting part of the swelling, by the bulging of its contents in different directions on the application of pressure which is not painful, by its more or less distinct fluctuation, and its transparency when present. The beating of the arteries is less distinct, and if present, as DUPUYTREN has noticed in one case, there is a motion and heaving of the swelling by the communicated pulsation, and not depending on its expansion and contraction (PIGNÉ.)

[Under the one term, *lymphatic bronchocele*, CHELIUS here includes two decidedly different diseases; *first*, cysts in the substance of the gland, which he has described in the principal clause of the paragraph, may fairly retain the name; and, *secondly*, serous cysts in the neck, which are called by MAUNOIR, *Hydrocèle du Cou*, but in reality are only cysts developed in the cellular tissue, and have nothing to do with the thyroid gland, except spreading over it as over the other parts in the neck; they will be again noticed in treating of Encysted Tumours. (p. 695.)—J. F. S.]

2169. In *Scirrhous Bronchocele* (*Struma scirrhosa*) the thyroid gland is less enlarged, but unusually hard, knobby, and irregular; the neighbouring cellular tissue wastes; from the very first the pain is violent and gnawing, and spreads up the neck; breathing and swallowing are very difficult, the one more than the other however, according to the part of the gland diseased. The scirrhous mass very soon adheres to the air-tube and to the muscles of the neck, and in the last stages the coverings become wrinkled and in folds. A sanious fluid often collects in the cells, immediately beneath the surface; the mass of the swelling presses backwards, by which the inconveniences are very much increased. At last it is converted into a carcinoma and a true cancerous ulcer, with which the neighbouring glands of the neck become swollen.

2170. Much uncertainty prevails as to the cause of bronchocele. In many districts, especially in low vallies, it is an endemic, unless its cause can be decidedly referred to the state of the atmosphere, the use of water containing salts of difficult solution, or of snow water (1). Cretinism and bronchocele do not stand in any necessary causal relation; the intellectual faculties are weak from birth in cretins, and in many this bluntness of intellect is complete, without swelling of the thyroid gland, at least without any such as can produce obstruction to the circulation. Experience, however, shows in most cases in cretins a peculiar misformation of the skull, by which the circulation in the carotids is more or less disturbed, and the enlargement of the thyroid gland produced by the greater inflow of blood (2). Females are more commonly subject to bronchocele than males, and its commencement usually begins with the menstrual development (3). Bronchocele frequently makes its appearance in scrofulous subjects (4). I have twice noticed congenital swelling of the thyroid gland. Violent exertion, labour pains, carrying heavy weights upon the head, screaming, and the like, frequently produce it, and sometimes very quickly. WALTHER supposes, that in aneurysmatic bronchocele the arterial system is always in a somewhat diseased condition, and has a greater or less degree of aneurysmal *diathesis*.

Of late the opinion advanced by BORDEU, of a closure of the tracheo-thyroideal passage as the cause of bronchocele, has been revived.

[(1) That the cause of bronchocele depends on the mineral substances contained in the waters of the districts where it is common, appears to be proved beyond all doubt by M'CLELLAN's observations (*a*), and he seems to think probably also on the state of the atmosphere. He refers to the observations of SAUNDERS (*b*) on the frequency of goître in Sumatra, in proof that snow water is not the cause of this disease, and he shows that it really depends upon the changed condition of the water which has circulated through the caverns of the Alpine or compact limestone, and although not percolating the rock itself, has acted upon the extraneous fossils and metallic substances with which such rocks abound, and become impregnated with them. He observes, that "Alpine limestone does not occur to any great extent in the mountains of Ireland, nor in those of Scotland and Wales; and in these countries goître is unknown. In England the disease is known by the name of Derbyshire Neck, and is principally confined to Derbyshire, where the particular rock in question forms the characteristic features of the county. In the Alps of Switzerland and Tyrol, where goître and cretinism both prevail, we have the authority of geologists that Alpine limestone and *nagelflugh* (usually composed of fragments of limestone more or less rounded, and of various magnitudes, cemented together by a basis of calc-sinter, JAMESON) compose the greatest portion of the mountains. Now this *nagelflugh* is the same rock, or nearly so, as that on which the villages of Goseragong, Batuda, and Deota, are erected, villages whose inhabitants are affected with goître to the extent of half their population." (p. 318.) In regard to the condition of the atmosphere as exciting this disease, he says:—"As this volatile poison (carbonic acid gas) exists in limestone to the extent of 44 parts in 100 of the solid rock, it is possible to conceive, that a sufficient quantity of it, to cause a more or less vitiated condition of the air may be extricated from limestone by atmospheric heat, assisted by such other causes as promote the decomposition of the rock. * * * A reference to the mineral topography of all the villages in Kemaon, which I have examined, but one, seems to favour rather than negative these views. * * * If there be difficulties in the way of conceiving the possibility of the emission of carbonic acid gas from limestone, its absorption by lime water may be suggested as a means by which it may be attracted by the moisture on the surface and at the base of calcareous mountains." (p. 321.)

(2) M'CLELLAN observes on this point:—"From goître as it appears in Kemaon, in its more distinct form, as well as in conjunction with cretinism, there are many reasons for believing that both complaints are intimately connected with each other; if not identically the same, they are mere modifications of different degrees of intensity of the same causes." (p. 335.)

(3) According to M'CLELLAN, "the disease begins at any period of life after the age of three years, and never as far as he has seen, arrives at its full size sooner than six years from the time of its commencement, but is generally much slower, its progressive augmentation seldom however becoming perfectly suspended during a residence in an affected village. * * * The usual size of a full-grown goître is about one foot ten inches in circumference, including the neck; and about two feet from one angle of the lower jaw to the opposite side, measuring under the tumour." (p. 317.)

INGLIS (*c*) says as to the age at which bronchocele is most usual:—"We may infer that the first ten years of life are comparatively exempt from the disease, and that the second ten are most subject to it; as out of one hundred and eleven, only eleven appear during the first ten, sixty-three during the second, and twenty-four in the following; the fourth ten years present four cases, the succeeding, four; and from the age of fifty to sixty-two only two cases are found." (p. 57.) Dr. COPLAND also observes that in a considerable number of cases which have come before him in females, he has never met with any before the period of commencing puberty." INGLIS has also compared the proportion of cases in this country, which have been collected by several writers, from which it appears that, in a hundred cases, those observed in men varied between two and five and a half *per cent.* (p. 32.)

(*a*) Above cited.

(*b*) Journey to Boutan; in Phil. Trans., vol. lxxix. p. 89. 1789.

(*c*) Above cited.

(4) Dr. Robertson indeed says:—"There are many reasons to induce us to regard goître as a particular variety of scrofula; in this country (England) it is only seen in highly scrofulous constitutions." As to the differences between scrofula and bronchocele stated by Postiglione (*a*), M'Clellan denies that the latter should be considered a merely local disease, or that it begins at a later period than scrofula and does not spontaneously disappear; but he admits that scrofulous glands often suppurate, whilst bronchocele rarely undergoes this change, which he considers the only real distinction between the two. From "the consideration of the predisposing cause," however, he observes, we are led to the conclusion "*that the same inherent diathesis, that under certain circumstances gives rise to scrofula, would, under exposure to the exciting cause of goître, occasion that peculiar form of disease.*" (pp. 339, 40.)]

2171. The size, duration, and nature of the disease, must be taken into the account as regards the *prognosis* in bronchocele. Small lymphatic bronchoceles in persons under twenty-four years of age are commonly soon cured. But the cure is more tedious if the swelling be larger and firmer and in older people. In large bronchoceles both internal and external employment of medicinal remedies are frequently useless, and a decidedly operative treatment must be employed to get rid of the swelling entirely, or at least to diminish it to such degree that the patient's sufferings may be bearable. The carcinomatous degeneration of the thyroid gland is incurable. In rare cases, bronchocele, when consequent on severe violence, cold and the like, may be attacked with more or less violent inflammation (*Thyreophyma acutum*) of Frank (*b*), in which case, with pain, increased heat, and sometimes with redness of the bronchocele, its tension and size quickly and considerably increase; the arteries of the neck pulsate strongly, the veins swell, there is difficulty in breathing and swallowing, determination to the head, redness and puffiness of the face, and frequently considerable fever. This inflammation may run to suppuration; the bronchocele may be completely or in great part destroyed; the collected pus, if the abscess be not opened in proper time may produce, by burrowing, considerable destruction of the neighbouring parts, may eat away even the air-tube itself and empty into it (*c*).

2172. The *treatment* of bronchocele must vary according to the nature of the swelling, as the remedies applicable to one form of the complaint, are of no use in another.

2173. In vascular bronchocele, the further growth of the tumour can alone be prevented and its diminution effected, at the very first, by general and local blood-letting, by the patient at the same time keeping perfectly quiet; by the continued employment of cold applications, and the internal use of *digitalis*, and by carefully avoiding every exertion; at least, I have in two cases followed this practice with success. If the vascular bronchocele have already attained considerable size, nothing is of any service, and the proper remedy for diminishing, if not of perfectly getting rid of the swelling, by which the inconveniences it causes are also removed, consists in *tying the superior thyroideal artery*, by which the thyroid gland is deprived of the greatest quantity of the blood which flows into it.

(*a*) Memoria Patologico-practica sulla Natura di Gozzo. Firenze, 1811. 12mo.

(*b*) De curandis hominum morbis Epitome, lib. vi. pars ii. p. lxxx. — Hupeden, Diss. sistens Animadversiones de affectionibus inflammatoriis Glandulæ Thyroideæ. Gottingæ, 1824.

(*c*) Baillie, Matthew, M.D., a Series o Engravings, with Explanations, intended to illustrate the Morbid Anatomy of some of the mos important parts of the Human Body. Secon Edition. London, 1812. 4to.

2174. This operation was first proposed, in way of question, by CHARLES G. LANGE (*a*), afterwards by JONES (*b*), especially applied by SPANGENBERG to aneurysmal bronchocele, and first undertaken by WILLIAM BLIZARD (*c*), in whose cases great diminution of the size of the swelling ensued, but the patient died of hospital-gangrene. WALTHER (*d*) performed the operation successfully; also COATES (*e*), WEDEMEYER (*f*), JAMESON (*g*), EARLE (*h*), BECK (*i*), and I, myself, in six instances. FRITZE (*j*), ZANG (*k*), and LANGENBECK (*l*) have met with fatal cases from bleeding, and inflammatory symptoms. GRAEFE (*m*) and myself (*n*) have operated without any permanent result.

2175. *Tying the superior thyroideal artery* is performed in the following manner. The patient seated on a high stool, opposite the light, inclines his head to the contrary side on which the operator stands, and rests it on the breast of an assistant. At the point where the artery is felt pulsating, the skin having been moderately stretched to prevent any fold, a cut is to be made through it, which beginning a little below the angle of the lower jaw and rather to its outside, is carried inwards and downwards along the inner edge of the *m. sterno-mastoideus;* and a second cut divides the *m. platysma myoides* in the same direction, the blood which flows into the wound being sopped up by an assistant with a moist sponge. The tip of the left forefinger is passed into the wound to ascertain most accurately the situation of the artery. A director is then pushed into the cellular tissue, covering the artery and the tissue divided with the bistoury; after which, it must be endeavoured to isolate the vessel with the blunt end of the director, with the handle of the scalpel or with the finger; but the use of any cutting instrument is to be avoided. The artery having been laid bare is now brought a little up, and a single round ligature carried with DESCHAMPS' needle about it, and tied with two single knots. The ends of the thread lying out of the wound are fixed with a piece of plaster, and the edges being brought together with strips of plaster, some wadding, and a compress are applied, and the whole kept in place by a circular bandage.

The laying bare of the artery is rendered easy by the upper edge of the bronchocele raising it up considerably. If the *m. omohyoideus*, as it passes above the artery, interfere with the isolation of the vessel, it may be advantageously cut through. It is easier to tie the artery between this muscle and its entrance into the gland than above it. I have, however, found, in one case in which I tied the artery above this muscle, that it was as easy as tying it below. A branch of the glossopharyngeal nerve, which lies close to the thyroid artery, must be taken care of, and drawn outwards. This also applies to the thyroideal veins, and the laryngeal branches of the thyroideal artery; the ligature is applied where this artery is already given off. Every spouting vessel must be taken up as the operation goes on.

Various propositions have been made as to the mode of finding the superior

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(*a*) Dissertatio de Strumis et Scrophulis, p. 16. Witemb., 1707.

(*b*) A Treatise on the Process employed by Nature in suppressing the Hæmorrhage from divided and punctured Arteries, and on the use of the Ligature, &c. London, 1805. 8vo.

(*c*) ALLAN BURNS, above cited, p. 203.

(*d*) Above cited, in his Journal für Chirurgie and Augenheilkunde, vol. ii. p. 584.

(*e*) Med.-Chir. Trans., vol. x. p 312. 1819.

(*f*) LANGENBECK's Neue Bibliothek, vol. iii. part ii. p. 185.

(*g*) American Medical Recorder, vol. v. p. 116. 822.

(*h*) London Medical and Physical Journal, vol. vi. p. 201. Sept., 1826.

(*i*) Above cited.

(*j*) HEDENUS, above cited, p. 255.

(*k*) Verunglückter Versuch, eine Kropfgeschwulst durch Unterbindung der Arteria thyreoidea superior zu heilen. Mitgetheilt van Dr. HÖREN; in RUST's Magazin, vol. vii. p. 315.

(*l*) Neue Bibliothek, vol. iv. part iii. p. 558.

(*m*) HEDENUS, above cited, p. 255.

(*n*) WEISSFLAG, Dissert., Animadversiones de Strumâ aneurysmaticâ et de Arteriis Glandulæ Thyreoideæ superioribus ligandis. Heidelb., 1823. 4to.—CHELIUS, Bemerkungen über die Struma vasculosa, und die Unterbindung der oberen Schilddrüsen-Schlagadern; in Heidelberg. klinisch. Annalen, vol. i. p. 208.

thyroideal artery, and the direction of the cut through the skin, and this step of the operation has been subjected to as definite rules, as for finding arteries in other parts of the body. According to JAMESON and ZANG, the cut through the skin should be begun on the middle of the lobe of the thyroid gland, near the upper edge of the thyroid cartilage, and continued for the length of two inches, according to JAMESON, of one, towards the clavicle. VON WALTHER and others fix for the beginning of the cut the space between the tongue-bone and the thyroid cartilage, from which it is to be continued three inches in length on the inner edge of the *m. sterno-mastoideus*, towards the breast-bone. According to LANGENBECK and BUJALSKY, it should begin immediately over the submaxillary gland, and be carried down in a straight line to the lower edge of the thyroid cartilage. All these rules are, however, precarious; the situation and course of the superior thyroideal artery vary so considerably, according to the size and extension of the bronchocele in different directions, that any such determination of the beginning and extent of the wound through the skin, cannot in general apply, and the above-mentioned rules on this point can alone be held with.

2176. The patient having been put to bed, with his head a little raised and laid on the side, must be kept quiet and treated precisely as when an artery is tied for aneurysm. It seems in this case always advisable after the operation to have recourse to a not inconsiderable blood-letting, for the purpose of checking a great flow of blood to the brain. If inflammatory symptoms, difficulty of breathing and swallowing, headache, and the like, should occur, general and local blood-lettings are to be considered the most efficient remedies. Violent cough requires extract of *hyoscyamus*, together with antiphlogistic means.

If both superior thyroideal arteries require tying, that of the other side must be tied after the wound of the first operation have healed. After tying, the bronchocele loses its elastic feel, the pulsation diminishes, the warmth lessens, and the swelling becomes smaller and shrivelled.

2177. If this operation be compared with those modes of treatment formerly recommended in that stage of bronchocele which threatens danger, as extirpation of the thyroid gland, the introduction of a seton, or issues, it must undoubtedly be preferred, partly on account of its easy performance, and partly for its happy result, when the bronchocele is of the vascular kind, that is, depending more on the enlargement of the vessels than on the thickening of the uninjectable part of its tissue, or on the pouring out of lymph-clots and degenerations in its cells. If the growth of the bronchocele cannot be in any way prevented, dangerous symptoms may be produced, and the superior thyroideal artery felt pulsating distinctly. A slight degree of still little developed general affection of the vessels accompanying aneurysmal bronchocele must not contraindicate the operation; but in far advanced diseased alteration of the heart and arterial system, those ill consequences at least may accrue after the operation, which happen after the operation for aneurysm, when there is an aneurysmal *diathesis* (1). If these circumstances be carefully considered before the operation, and that performed with due caution, the results, i most cases, correspond with our expectations. To this must be adde that aneurysmal struma, as above mentioned, (*par.* 2167,) is not common that the symptoms may be illusory, since the bronchocele characterized a aneurysmal, exhibits in its interior more or less thickening, cavities an cells filled with serous or brownish fluid, and that such bronchocele ma also be efficiently treated with seton (*a*); hence the propriety of tying th superior thyroideal artery is not disparaged.

VON WALTHER doubts the possibility of the growth of the tumour afte tying the superior thyroideal artery, and asserts the adhesion of a ver

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(*a*) RUST'S Magazin, above cited.—LANGENBECK, above cited.

large portion of the expanded and tied vessel. I have, however, noticed the contrary, as the growth of the swelling may be continued by the enlargement of the inferior thyroideal artery and its communication with the superior (2). In general this does not happen, and perhaps can only, when the inferior as well as the superior artery is at the same time enlarged (*a*). It must, however, be always remembered, in deciding on tying the superior thyroideal artery, that if it be much changed by disease, the ligature will not effect its obliteration, but bleeding must ensue, which in many instances will have an unhappy result.

(1) P. von Walther (*b*) has successfully practised tying the superior thyroideal artery as above directed, in a case of aneurysmal struma.

[(2) In confirmation of Chelius's statement regarding the growth of the bronchocele, after tying the superior thyroideal artery, although the swelling had at first decreased even considerably, Crawford (*c*) states that Coates informed him as to the final result of his operation above mentioned, "though the case proceeded extremely well for some time after the patient was discharged and lost sight of, yet the tumour subsequently, he understood, enlarged, and in the end destroyed the woman by suffocation." Also, in a case of Wickham's of Winchester, the largest he ever saw, "after the ligature of the artery, the swelling gradually diminished for about six weeks, after which it as gradually regained its former size. It seemed that the decrease of the tumour continued so long as the part of the gland, which had been supplied by the vessel, remained without nourishment; but as soon as the supply was restored by the anastomosing branches from the opposite superior and the two inferior thyroideal arteries, the swelling returned to its former dimensions. Such, I should conceive, would be the case unless all the thyroideal arteries were obliterated, which it would be a very difficult task to accomplish, if not altogether impracticable from the depth of the lower vessels." (p. 331.)]

The circumstance above noticed in regard to the enlargement of the inferior thyroideal artery has led to the proposal of tying it also. Velpeau (*d*), Dietrich (*e*), and Laymann (*f*) have given special directions for finding this artery.

There may be cases in which after tying the superior thyroideal artery, the bronchocele does not properly decrease, on account of the existing enlargement of the inferior thyroideal artery. But as regards the mode of tying the latter vessel, that which has been already mentioned as to the direction of the cut for tying the superior artery, applies to it also. Only if the inferior thyroideal can be decidedly distinguished, by its pulsation and size at the lower part of the bronchocele, may it be decided to tie it, and the direction of the cut must then be decided by the situation of the vessel. In a case in which I had tied the superior thyroideal artery and the bronchocele had diminished considerably, I felt the inferior artery pulsate distinctly, and could have undertaken tying it with ease, if the diminution of the swelling and the subsidence of the previous symptoms had not rendered it unnecessary.

2178. Lymphatic bronchocele, if not exceedingly large, and of very long duration may be always cured by the use of internal and external remedies, or at least be so far controlled, that the disease produces no serious inconvenience.

2179. Of all the remedies which have been employed internally for bronchocele, burnt sponge has been most used. It has been given in different forms, and with various combinations; but according to my experience most advantageously with red foxglove. Iodine, which is considered the most important element in the burnt sponge, has, from Coindet's (*g*) experience and recommendation acquired great repute. Forty-

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(*a*) Chelius, above cited. p. 233; and in Heidelb. klinisch. Annalen, vol. i. part i.

(*b*) In his Journal für Chirurgie und Augenheilkunde, vol. ii. p. 584.

(*c*) Cyclopædia of Practical Medicine, vol. i.

(*d*) Traité d'Anatomie Chirurgicale, vol. ii. Paris, 1825. 8vo.

(*e*) Das Aufsuchen der Schlagadern, p. 95. Nürnberg, 1831.

(*f*) Dissert. de ligandis Arteriis thyreoideis, præsertim inferioribus ad sanandam Strumam. Bonnæ, 1833.

(*g*) Découverte d'un nouveau remède contre le Goître; in Bibliothèque Universelle de Genève, vol. xiv. p. 190. 1820.—Nouvelles Recherches sur les effets de l'Iodine et sur les précautions à suivre dans le traitement du Goître par ce nouveau remède; in Bibl. Univers., vol. xvi. p. 140. 1821.—Formey, Bemerkungen über den Kropf und Nachricht über ein dagegen neu entdecktes Mittel. Berlin, 1820.—Graefe, Ueber die Indicationen, nach welchen die Iodine gegen Kröpfe anzuwenden ist; in Journal für Chirurgie und Augenheilkunde, vol. ii. p. 616.

eight grains of iodine are to be dissolved in an ounce of spirits of wine, and of this ten drops are to be taken thrice a day, in a glass of water sweetened with sugar. After eight days the dose is to be increased to fifteen drops, and some days after to twenty drops. It is observed in this treatment, that within the first eight days, the skin over the bronchocele is less tense, the substance of the swelling softer, the several parts of the gland more distinct, and its removal gradual. Small bronchoceles usually disappear in eight or ten weeks, and very large ones diminish. In this employment of iodine it is noticed, that besides the softening and removal of the bronchocele, usually the pulse becomes quickened, and that there are other variations from the natural condition. On the setting in of these symptoms the iodine must be at once left off, and only again employed eight or ten days after, when they have subsided (1).

Very large doses of iodine, or its too long continued use cause palpitations of the heart, dry, frequent cough, loss of sleep, quick wasting, loss of power, swellings of the bones, tremors, a painful hardness of the bronchocele, sometimes wasting of the breasts, considerable and continued loss of appetite (2). These symptoms may be always removed by warm bathing, valerian, quinine, volatile alkalies, and other antispasmodics; and the painful hardness of the bronchocele by leeches and softening fomentations. In consequence of these effects of iodine, it must always be given with caution, and with due reference to the constitution of the patient, and the condition of the bronchocele. Very tense, painful bronchocele make no difference; however, if there be in addition spasms or bilious symptoms, leeches, softening fomentations, antispasmodic, and antigastric remedies must be employed. The use of iodine is contraindicated in pregnancy, in the disposition to flooding, in incipient diseases of the breast, in wasting fevers, and in irritable and nervous constitutions. Iodine acts especially on men, who have no other ailment than bronchocele, if it occur in later life, or the patient have reached manhood. When the symptoms endanger life, or become fatal from the use of iodine, their cause depends on inattention to the points above noticed; or in the mode in which the iodine is employed (*par.* 776.) As in using tincture of iodine by mixing it with sugared water, the iodine is thrown down, and so gets into the stomach in an undissolved state, it seems preferable to use it in the mode prescribed by LUGOL, half a grain to a whole grain of iodine dissolved in a pint of distilled water, to be taken during the day (*par.* 776); or a solution of hydriodate of potash (*par.* 856) may be given, from which I have never noticed the symptoms just stated.

The other remedies which have been also employed in bronchocele, as calcined egg shells, *barytes*, carbonate of soda, of potash, soap, vinegar of squills, oxysulphuret of antimony, *digitalis*, *belladonna*, and many others, are some of them little longer in use, and some given in combination with burnt sponge.

GRAEFE considers the following as very efficacious:—

℞ Potass. tart.
Spong. ust.
Sacch. alb. āā ʒss.
Ammon. hydrochl.
Rad. imperator.
Cinnam. acut. āā ʒij.
Sulph. antim. aurat. ℈j.
Piper. long. ʒi.
Misce ut fiat pulvis subtilissimus.

Persons who are little irritable, pasty, and have large lymphatic bronchocele, should take daily, morning and evening, a small heaped-up teaspoonful. Irritable wasted persons, whose bronchocele is small, should take the same dose only once. The remedy is very efficacious, though most nauseous when swallowed dry, and must be continued longer if the patient take it in water.

[(1) INGLIS objects to COINDET's mode of employing iodine, that "were it used in any quantity, the result would be a deposition of pure iodine upon the mucous membrane of the stomach, on account of the affinity which exists between alcohol and water. Nor would the evil stop here. Iodine has a great affinity for hydrogen: so that whenever it comes in contact with other vegetable or animal matter, it decomposes it, taking its hydrogen to form hydriodic acid; the mucous membrane of the stomach would therefore suffer, which dissection after death proves really to take place, by poisoning with iodine; there being always found, as ORFILA has shown, ulceration of the mucous membrane of the stomach and intestines. On which account he prefers, even to the weakest tincture, an aqueous solution either of the hydriodate of potassa, the hydriodate of iron, or of iodine rendered more soluble by the presence of a salt, as the nitrate of ammonia, the hydriodate of soda, or the hydriodate of potassa." (p. 65.) But of these several preparations he gives preference to the ioduret of iron, in the following form:—℞ *ferri iodur.* ʒss., *potass. hydriod.* ℈j., *aq. destill.* ℥jss. *Solve. Cap.* gutt. xx. *ter die ex aquâ;* and for the following reason:—"That in his goitrous patients he generally found some catamenial irregularity, more particularly *amenorrhœa.* Now he found that when the tincture of cantharides, and of the muriate of iron failed to induce the natural secretion, the ioduret of iron often succeeded; its use, therefore, is peculiarly indicated in bronchocele." (p. 67.)

(2) Still more serious symptoms than those mentioned result from the improper use of iodine (*a*). "The patient becomes affected with a sense of faintness, tremor, and sinking, dimness of vision, palpitation, and other symptoms of a nervous kind. The degree of tremor, Dr. GAIRDNER informs us, is sometimes so great as to present some resemblance to *chorea,* though the limbs can always be kept steady. More violent effects than these occur at times; symptoms apparently proceeding from the direct and acrid effects of iodine on the alimentary canal, and strongly resembling the Indian cholera; violent and incessant vomiting, strong spasms of the back and legs; extremely frequent, small and oppressed pulse, urgent thirst, and excruciating pain of the stomach and bowels; the latter being sometimes violently purged, at other times obstinately confined." (p. 329.) These severe symptoms I have never witnessed, perhaps because I have been accustomed to use iodide of potass, which the stomach will bear, in doses up to five grains, and even more, though continued for many weeks. Occasionally, however, the iodide of potass will cause nausea and loss of appetite, so that its discontinuance for a time will be necessary. I have seen it also several times produce ptyalism in persons of irritable constitution. On these accounts, it is necessary to watch its effects carefully.

The best modes of giving iodide of potass, is, in doses of from three to five grains, according to the age and condition of the patient, twice a-day, either in compound decoction of sarsaparilla, or in compound infusion of gentian, or pennyroyal water, with some warm tincture.—J. F. S.]

2180. Of the very great number of external remedies which have been advised to be used alone, or at the same time with internal medicines, the following may be mentioned as the most effectual and most useful; frequently rubbing the swelling with flannel, rubbing with camphorated liniment, with diluted caustic liquor of ammonia, soap liniment with liquor of ammonia, with *ung. digital. purpur.*, with mercurial ointment and tincture of cantharides, with naphtha, with fœtid oil of tartar and opium, nightly application of discutient plasters of soap, of mercury mixed with volatile salts and camphor, *empl. cicut. ammoniaco c.*, and the like. As the internal use of iodine, even when employed with the greatest care frequently produces injurious effects, COINDET (*b*) advises its external application, and frequent experience has proved its great influence in bronchocele, as well as in other glandular swellings. Half a dram of iodide of potash is to be made into an ointment with half an ounce of lard, and a piece as big as a nut rubbed into the bronchocele morning and evening. The cure is mostly completed in from four to five weeks;

(*a*) Dict. of Pract. Med., vol. i.

(*b*) Notice sur l'administration de l'Iode par frictions; et sur l'application de ce médicament au traitement des scrofules et des quelques maladies de système lymphatique; in Biblioth. Univers. de Genève, vol. xvi. p. 326.—BIEHLER, Beobachtung über die äussere Anwendung des hydriodinsauren Natrum; in VON GRAEFE und VON WALTHER'S Journal, vol. iii. p 277.—BAUP, Observations sur les Effets de l'Iode contre le Goître; in Bibl. Univers. de Genève, vol. xviii. p. 304.

in some instances it must be combined with the internal use of iodine. If the bronchocele become painful and harder, this ointment must be withheld for a time, and leeches and warm applications made use of. Caution must also be recommended in the external use of iodine.

[In using iodide of potash as an ointment, it is better not to rub it in, as almost invariably, sooner or later, and in irritable persons after two or three rubbings, it irritates the skin so much, that the cuticle separates and a sore is produced, which compels the suspension of its employment. All the wished for advantages will be gained by simply smearing the ointment thickly over the affected part, and covering it with a piece of lint once or twice a day; and very rarely is the skin in this way irritated. Some practitioners paint the swelling over with the tincture of iodine; but this not unfrequently blisters the skin, and therefore its use cannot be persisted in. —J. F. S.]

2181. Of all the remedies, both internal and external, recommended in the treatment of lymphatic bronchocele, I prefer the internal use of burnt sponge with ginger, sometimes with the addition of *digitalis*, and frequent smart rubbing with camphor liniment. From the results of my own experience, I have not done more by the internal and external use of iodine than by the plan just mentioned; and where that has been inefficient, so has also iodine.

2182. When considerable alteration and cartilaginous hardening has taken place in lymphatic bronchocele, and when by the cautious employment of internal and external remedies, no diminution of the swelling has been produced, and symptoms threatening life arise, the lessening of the tumour may be effected by tying the superior thyroideal artery, if it be much enlarged, and pulsate violently. But in these cases the introduction of a seton is most advantageous, by which the destruction of the swelling, by suppuration, and the obliteration of the vessels by the inflammation excited, is effected.

2183. The seton should be passed either from above downwards, or from one side to the other, through the substance of the swollen gland; in doing which the superficial veins must be cautiously avoided, and the needle not passed too deeply. In general a reddish-brown thickish fluid escapes; and some days after, the seton must be drawn further; the inflammation thereby excited is of little inconvenience to the patient. If the seton be not sufficiently active, a due degree of irritation may be excited by smearing it with some acrid ointment; or pieces of hellebore root may be introduced with it. The seton must remain in for a long time in order to keep up suppuration till the cure is complete, and to prevent the burrowing of the pus. Suppuration rarely extends throughout the whole gland, but generally destroys only that part of it which is in the neighbourhood of the seton. If luxuriant granulations appear at the openings, they must be snipped off. When suppuration ceases, and the wound has perfectly healed, the lessening of the bronchocele continues till it has completely disappeared. For some time the skin has a wrinkled appearance, but soon afterwards becomes natural. At the scars the skin at first seems adherent to the thyroid gland, but this also disappears in a little time. QUADRI's successful cases show that a seton may be passed repeatedly, even as often as sixteen times, in various directions through the bronchocele, without any particular symptoms appearing. In the re-introduction of a seton-needle through the still remaining part of a bronchocele, QUADRI found considerable resistance at the part where it had been previously employed; on which account he concluded that the recurrence of bronchocele, after using a seton, was very improbable.

Although the use of a seton is not so dangerous a remedy as by many supposed, I have known, from my own experience, as well as that of others, fatal results, which seemed to me to depend on the unhealthy and copious suppuration which ensued when the seton had been drawn through the larger cavities of the bronchocele, the firm and cartilaginous walls of which did not fall together, and foul ichor, collected from one dressing to another, caused fatal reaction (*a*).

2184. Of similar operation to the seton is the emptying a bronchocele with a sufficiently large cut, and exciting inflammation and suppuration by introducing lint into it. The front of the gland is laid bare, with a longitudinal cut, the bleeding vessels tied, the swelling cut into and emptied of its contents, by pressure made upon it, lint introduced and suppuration endeavoured to be excited by digestive remedies. This treatment appears specially applicable in that kind of lymphatic bronchocele which contains fluid in several small or large cavities, and withstands the use of the internal and external remedies above mentioned, as well also as when by the introduction of the seton dangerous symptoms are feared from the collection of foul ichor (*b*).

The mere puncturing and emptying the fluid in *Struma cystica* is only palliative, and the fluid soon re-collects, and frequently soon exceeds what it was before. Maunoir has, after puncturing the swelling, thrown in irritating injections; but experience does not speak in favour of this mode of treatment, as the fluid, if not very irritating, is of no use, and if it be, may produce very violent symptoms. The objections already made to the use of the seton apply also here, although it is used by many in this form of bronchocele. As notwithstanding the inlying of the seton the fluid oftentimes will not escape properly, the introduction of an elastic tube into the lower opening has been advised, through which, at the same time, soothing and irritating injections may be made (Pigné after Sanson.) The copious suppuration gradually diminishes, the cavities shrink, and, by degrees, are converted into a single canal (*c*). Serious symptoms may, however, occur after this mode of proceeding, and the cure is in general only completed in from five to six months.

Chelius has not correctly stated Maunoir's practice. It is perfectly true that at first he used injections, having previously emptied the cyst with a trocar and canula; but he found their consequences so serious that he speedily gave them up, and employed setons with success in the five cases which he relates. The use of setons has also been followed successfully by O'Beirne and Bransby Cooper, without any additional irritant.—J. F. S.]

2185. The favourable results to which experience points from the above-mentioned various modes of operation, in the most severe cases of struma, which have resisted all the internal and external remedies, and endangered life, must decidedly reject the *extirpation of the bronchocele* as very dangerous, and almost entirely to be forbidden. Single cases in which this operation has been successfully performed do not oppose this opinion, as on the other hand just as many have been adduced in which the patient has died either under the hands of the operator, or a short time after the operation, in which, on account of the bleeding, the completion of the operation was prevented, or the patient was only saved with the greatest difficulty.

(*a*) L. Heister, Dissert. de Tumore cystico singulari. Helmstad, 1744.—Stergman, Dissert. de Strumâ. Jenæ, 1795.—Klein, Beobachtungen über die Heilung des Kropfes durch Vereiterung vermittelst eines durch gezogenen Haarseiles; in von Siebold's Sammlung chirurgischen Beobachtungen, vol. i. p. 11.—Quadri, Memoir on a New Mode of treating Bronchocele; in Med.-Chir. Trans., vol. x. p. 16.—Copeland Hutchison, Cases of Bronchocele, or Goître, treated by seton, with Observations; in Med.-Chir. Trans., vol. xi. p. 235.—Chelius, above cited, p. 238.

(*b*) Fodere, above cited.—Lemaire, in Nouveau Journal de Médecine, vol. x. p. 25. 1821.—Beck, above cited.—Rognetta, in Revue Medicale. 1834, vol. i. p. 379.—Heidenreich, in von Graefe und von Walther's Journal, vol. xxiii. p. 680. 1835; and in Allgemeine Zeitung für Chirurgie, innere Heilkunde und ihre Hülfswissenschaften, 1843, No. 4, 5, has communicated the largest experience on this mode of operative treatment of bronchocele, together with careful anatomical observations.

(*c*) O'Beirne; in Dublin Journal of Medical Science, vol. vi. p. 1. 1834.—Bransby Cooper; in Guy's Hospital Reports, vol. i. p. 105. 1836.

In those cases only, where there is a partial, defined swelling of the thyroid gland, which is movable or has a neck, and which is unconnected with the deep important organs of the neck, is extirpation to be held indicated. The skin is to be divided on the tumour and separated from it on each side, the swelling drawn well forwards with a hook, and its cellular connexions carefully separated with some strokes of the knife, in doing which the blood must be cautiously sopped up with a sponge, the spouting vessels tied directly, and if possible before they are cut through. If the neck of the swelling be connected with any important organ, if there be reason to fear any vessel running through it, the rest must be tied. The treatment of the wound is to be conducted according to the general rules (*a*).

[**Green** operated in 1829 on a bronchocele of this kind in a woman twenty-nine years old. The swelling was as big as the fist, growing from a small base on the right side; its surface presented many enlarged veins, and an artery of equal size with the radial ran across its base; it was very firm and irregularly lobulated. Two semicircular cuts, meeting above and below, and including the skin covering the swelling, were made, and the divided veins bled freely. The artery was found and tied; but in doing so was wounded, and there was much bleeding. The base of the tumour was then cleared, and bleeding from the jugular vein was stopped by pressure upon it. The windpipe and the sheath of the carotid artery were exposed as the base of the swelling was isolated, and a strong ligature having been passed round it, the tumour was removed at a stroke, and the bleeding ceased; but it recurred half-an-hour after, was evidently venous, and stopped by pressure. In the course of a few days suppuration ensued, and the ligature was removed, but low fever ensued, and she died on the tenth day after the operation.]

2186. In cases in which, on account of its situation and condition, the extirpation of the bronchocele has seemed to be indicated, tying it at its base has been performed successfully by **Mayor** in three, and by **Bach** (*b*) in two, instances. The skin is divided by a crucial cut upon the swelling, the flaps dissected back to their base, and the neck of the tumour isolated as far as possible with the finger. A strong ligature is then applied around it, and tied with a loop-tier. According to **Mayor**, the ligature should be tied as tight as possible; but according to **Bach** only lightly for the first two or three days, for the purpose of preventing the violent pain, symptoms of choking, bleeding by cutting through a vessel, and inflammation of the veins, but afterwards it is to be tightened. When the tumour has mortified, it should be cut off in front of the ligature, which must then be tightened, so as to hasten throwing off the stem. This tying, after previously laying bare the neck, is indeed less dangerous than extirpation; it is, however, very hazardous. The whole swelling must become gangrenous, so that a mass of filth remains till it is entirely thrown off, and there is still a horrible wound, which always leaves an ugly scar; besides which the inflammation and symptoms of suffocation may be very severe. **Regal de Gaillac** (*c*) has made use of the subcutaneous ligature for removing bronchocele.

III.—OF ENLARGEMENT OF THE CLITORIS AND OF THE LABIA.

(*Hypertrophia Clitoridis et Labrorum*, Lat.; *Vergrosserung der Klitoris und der Schaamlippen*, Germ.)

2187. The *clitoris* may, either as a congenital vice, or as consequent on early masturbation, enlarge to such size as more or less to destroy the functions of the female generative organs, and even be capable of leading to vicious practices. The condition of the *clitoris* may be, excepting its

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(*a*) **Hedenus**; in von **Graefe** und von **Walther**'s Journal, vol. ii. p. 240.—**Graefe**, see **Hedenus**, De Glandulâ Thyreoideâ tum sanâ quam morbosâ, p. 267. Lips., 1822.—**Mandt**; in **Rust**'s Magazin, vol. xxxvii. part iii. p. 337.—**Zartmann**, Dissert. de Strumæ extirpatione. Bonnæ, 1829.

(*b*) **Hirtz**; in Gazette Médicale de Paris, vol. ix. p. 9. 1841.

(*c*) Bulletin général de Thérapeutique. 1841, Oct.—**Liston**; in Lancet. 1841, vol. i. p. 691.—A. **Sanson**, Des Tumeurs du Corps Thyreoide et leur Traitement. Thèse de Concours. Paris, 1841.

size, either natural, or it may deviate more or less from its natural state, its vessels may become varicose, and the like.

Syphilitic affections not unfrequently give rise to considerable enlargement of the *clitoris*. I have seen an instance in which it was about two inches long; it became hard, and its natural structure was completely destroyed; and the same happens in scirrhous degeneration of the organ.

2188. When the *clitoris* is of very great length, nothing is left but to cut it short; and if otherwise degenerated, to remove it down to the healthy part. The patient being held by assistants in a proper posture, and the *labia* separated, the *clitoris* should be taken with the fingers or forceps, drawn forwards, and the excess, or the degenerated part, cut off with a bistoury, or scissors, at one or more strokes. The bleeding, which if the vessels be large is very great, must, as far as possible, be stanched by tying, by cold water, by styptics, and by pressure against the arch of the *pubes*. If there be no bleeding, the surface of the wound must be dressed with dry lint, covered with a compress, and this fastened with a T bandage. Some moistened linen should also be placed between the *nymphæ*, and some wads of lint in the *vagina*, to prevent it growing together and narrowing. The after-treatment is conducted on the ordinary rules.

The case of an idiot, cured by the removal of the *clitoris*, is related by a physician of Berlin (*a*).

2189. The *labia* may, like the *clitoris*, either from original formation, or as consequence of continued inflammation, syphilitic sores, and the like, attain such size as to cause difficulty in walking, and interruption to coition; and, by their continued irritation, excoriations, and even deep ulceration, may be produced. With enlargement of the *labia* the vessels commonly become varicose, the *labia* themselves quite hard, and the discharge of the urine may be more or less completely prevented.

For enlargement of the *labia* from *elephantiasis* see Birrel (*b*); also Monod (*c*).

[Enlargement of the *labia* to such size as to need removal with the knife, is not, so far as I am aware, at all common. But great increase in the bulk of the *nymphæ*, in which also the prepuce of the *clitoris* participates, is of very frequent occurrence in women of the town. In St. Thomas's Museum there is an instance of one *nympha* removed by Astley Cooper, which is as big as two fists, and has a very whimsical history attached to it. The disease merely consists of a large development of tough cellular tissue within the double skin; and in general is not very vascular.—J. F. S.]

2190. It is rarely possible, except when the enlargement of the *labia* results from continued irritation, or venereal affection, and has not yet attained any considerable size, by proper treatment for the removal of the irritating cause, or of the *syphilis*, to be of any use. If the enlargement be consequence of the congenital formation, or if accidental, but have long continued, and the structure of the *labia* be considerably altered, their removal with the knife or scissors is the only remedy. The patient is to be placed in the same posture as for shortening the *clitoris*, the enlarged or degenerated *labium* is to be taken hold of with the fingers of the left hand, drawn a little forwards, and with a convex bistoury, or with curved scissors, at one or more strokes, the degenerated or enlarged *labium* is to be removed. The wounded surface must be carefully examined, and if any degeneration remain, it must be seized with the forceps and cut off. The bleeding is to be stanched by

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(*a*) von Graefe und von Walther's Journal, vol. vii. p. 1. 1825.

(*b*) Edinburgh Medical and Surgical Journal, vol. xxiii. p. 257. 1825.

(*c*) Bulletin de la Societé Anatomique, Sept. 1835, p. 12.

tying the vessels, or if this be not possible, with cold water or pressure. The same dressing is to be employed as for the *clitoris*. If the enlargement be very great, two moderately large semilunar cuts must be made, to include the degenerated part; which, having been removed, the edges of the wound are to be brought together lengthways, throughout their whole extent, with suture.

[The removal of the enlarged *nymphæ* is usually best performed with a pair of small shears, of sufficient size to take off the whole at a stroke. If the prepuce of the *clitoris* be also enlarged, it is rarely necessary to meddle with it, as after the removal of the *nymphæ*, it in general shrinks to a moderate size. I have not found it needful, in any case in which I have operated, to employ sutures; or to do more, than at first to apply a cold wet rag to stanch the bleeding, and afterwards a poultice; as the wound skins, the scar contracts, and the edges soon draw together.—J. F. S.]

IV.—OF WARTS.

(*Verrucæ*, Lat.; *Warzen*, Germ.; *Verrues*, Fr.)

2191. Warts are variously-shaped growths of the skin which appear under two different forms. They are either *superficial*, with a broad base, or most commonly attached by a thin neck, do not project much above the surface of the skin, are soft, compressible, covered with the ordinary *epidermis*, and have the same sensibility as the skin. Warts commonly arise at those parts where the skin is delicate and sensitive; specially, therefore, on the face, neck, and back of the hand, and more frequently in women than in men. Or warts are *thick*, *have a broad base*, *and situated more deeply in the skin*; their form is conical or cylindrical; they are immovable and hard, outspreading on their top; and the skin about their base seems burst through, as by the eruption of the wart, and its colour is completely changed; the top of the wart is almost insensible, but frequently it is very painful within.

[Besides the warts here mentioned, the generative organs are frequently attacked with two kinds. one of which has much the appearance of the "seedy wart," as it is commonly called, on other parts of the body, and is a very common attendant on gonorrhœal discharge, which has been allowed to remain on the skin and irritate it. At first this kind of wart has a little pedicle, with, in comparison to its size, a broad head, consisting of little flat prolongations. like the tips of leaves closely set together; from this there is an acrid secretion which is contagious, and wherever it rests, produces in the same individual, or in another having commerce with her or him, the same growth. The neighbouring parts soon become contaminated; and it is not unfrequent to see the whole of the external female organs thickly covered with them, as also the *glans penis* of the male; and should there chance to be in the latter, *phimosis*, the warty growths rapidly increase, and distend the prepuce, till at last it bursts, and their protrusion gives the *glans* a cauliflower-like appearance. The other kind of venereal wart has not the narrow neck nor the leaf-like head, but is broad-based, not unfrequently sore, and sometimes even having somewhat the character of a shallow badly-skinned ulcer; this form more commonly is noticed when there are—or have been—sores, having a very chancrous character; and are often observed to exist when decided syphilitic eruptions cover the body.

Warts sometimes take on a malignant character, and affect the neighbouring glands, and occasionally they seem to have a malignant character from the very first. I have seen them upon the back of the hand and on other parts of the body; they generally have a broad base and a sort of cauliflower surface, and spread by enlargement of their base; sometimes they are tender and painful, at other times, not so; their head breaks off easily and bleeds freely, and sometimes ulcerates, still, however, retaining the same warty character.—J. F. S.]

2192. The *causes* of warts are, for the most part, unknown; local influences, as pressure, blows, chafing, and the like, frequently seem to produce them; their foundation, however, is, in general, constitutional as they are produced in great numbers in certain persons, and especially on different parts, without any local influence being discovered; and they recur after having been removed by local remedies. The blood may be in such state that where it touches the skin it may produce warts.

2193. In *treating* warts it must first be considered whether they depend on any decided internal cause or not, in order to employ the proper opposite remedies. Besides attention to diet, mercurial remedies, soap, fluid extracts, and resins, are recommended. In using these means, the warts often of themselves, or by the application of external remedies at the same time, waste away. Frequently also, at the period of puberty, they drop off without any assistance.

2194. The external remedies advised for treating warts are very numerous; but they are all alike, in that they may be destroyed by caustic, or removed by tying, or the knife. To the caustics belong the juice of *euphorbium*, hemlock, *sedum acre*, strong acetic acid, tincture of cantharides, caustic ammonia, sulphuric acid, hydrochloric acid, butyr of antimony, lunar caustic, and the like, with which the wart is well to be touched; and this must be repeated as often as the crust falls off till the wart is completely destroyed. These remedies are especially applicable, if the wart have a broad base. If it have a neck, it may be tied with a thread, which must be tightened daily; or it may be cut off with a knife. If the wart be thick, it is best to remove part with the knife, and destroy the remainder with caustic. It must not be forgotten, however, that in thus treating warts, unhealthy sores are often produced, and that the scars, after using caustic, are more disfiguring than the previous warts. Warts which are very hard, irregular on their surface, and very painful, disallow the above modes of treatment; and if anything be done, their complete removal, without leaving any of the degeneration, together with the proper remedies for any general disease connected with them, must be employed.

[Common warts, when occurring, as they frequently do, in children, in large numbers upon the fingers and hands, often disappear with as little apparent cause as they have originated, and frequently, in a very short time. I do not think much advantage is gained by teasing them with any application; for they are rarely cured more quickly than if left alone. When, however, there be a single one or two upon the neck, or on the edge of the eyelid, or on the lid itself, it may be as well either to snip it off with scissors, or to tie it with a thin thread; and this more especially in adults. If a common wart have, as it has occasionally, a very broad base, attempts to remove it, by destroying with strong acids, will now and then set up inflammation of the absorbents; and when this has been checked, and the destroyed wart sloughed out, the scar takes on again the same disposition, and the wart is reproduced; it may become of larger size than before, of which I have had personal experience.

Gonorrhœal warts, if few and distinct, may be snipped off, and the wound touched with caustic potash; but if very numerous and close set, so that this cannot be done, they must be thoroughly destroyed piecemeal, either with caustic potash or nitric acid; but before leaving the patient, it will be proper to neutralize the application with acid or alkali, as the case may be, or a troublesome, sloughy, and often unmanageable sore, will be the consequence. Whilst these warts are small and short they may very frequently be removed, by strewing daily upon them equal parts of savine and sulphate of copper, powdered and well mixed together, the parts having been previously well cleaned and dried, and the collection of the gonorrhœal matter upon the skin prevented by strict attention to cleanliness. Fumigation with cinnabar is often also very efficacious. The broad warts, which seem to be truly syphilitic, almost invariably disappear under a mercurial course.

Malignant warts must be removed with the subjacent cellular tissue down to the muscle on which they are seated. The application of caustic only irritates, and quickens their growth.—J. F. S.]

V.—OF CALLOSITIES AND CORNS.

(*Indurationes et Clavi*, Lat.; *Schwielen und Hühneraugen*, Germ.; *Cors*, Fr.)

2195. Callosities are more or less circumscribed thickenings of the *epidermis*, produced by continued pressure. They are most commonly seen on the backs of the toes, on their joints, especially on the last, and between the toes *(corns.)* They are generally flat, as if pressed into the skin, are produced slowly, and only when they have become large cause darting pain, under which circumstances the neighbouring parts are inflamed by the pressure of the callous mass. Sometimes they commence with violent pain, especially in persons whose skin is tender. They are more troublesome in warm than in cold weather. The skin is indented in the middle of a corn, and on examination, the *corion* is often found perforated.

These projections of the *epidermis* consist of two substances; the upper is dry, in shape like the head of a nail, and formed of layers of *epidermis*, one upon the other, which often readily separate from each other, especially if softened by bathing the feet. This substance shows no organization. The other part deeper and semitransparent forms the base of the former, penetrates through the thickness of the skin down to the tendon, to the ligament, and even to the bone, upon which it is in a manner rooted, which shows it to have a certain degree of organization. Breschet observed it to be penetrated in different directions by numerous vessels. It is this which especially causes the pain in changes of the weather, although that is also produced by the pressure of the horny substance upon the surrounding parts, in consequence of which inflammation of its whole extent ensues, and may even spread (Pigné.) The corn is, according to Brodie, in the beginning, a thickening of the *epidermis* as a consequence of greater secretion from the *cutis* from pressure; subsequently a *bursa* forms; by degrees inflammation of this *bursa* takes place beneath the horny *epidermis*, in consequence of which it becomes very painful and runs on to abscess. Rosenbaum (*a*) explains the origin of this *bursa* as consequence of the closure of the glands of the skin.

2196. The *cure* of callosities and corns requires, above all things, the removal of pressure from tight shoes, and even from tight stockings; after which they gradually subside of themselves. If the corn be upon the sole of the foot, a felt sole must be worn, with a hole in it, to receive the corn. As palliatives may be used, softening plasters, frequently bathing the feet, shaving off in slices, or scratching away with the knife, or with wetted pumice-stone, the application of a plaster, with a hole in its middle, into which the corn may be received. The complete removal of the corn, by dividing the skin around it with two cuts, lifting it up with forceps, and extirpating it with the knife or with scissors, which is always attended with considerable pain; also its destruction with caustic; and strewing it with different remedies, after previously removing some layers of the callous mass, are mere palliatives, if the cause, that is, pressure, be not removed. Some persons are more subject to corns than others.

The numerous remedies recommended for corns are either softening plasters and salves, or irritating and caustic applications, which produce either inflammation, suppuration, and throwing out of the corn, or its destruction. The latter remedies are objectionable, as they often produce violent inflammation, extensive suppuration, and danger of gangrene. Also in removing them by slices, care must be taken that neither pain nor bleeding arise; and the same also applies to the subsequent touching with lunar caustic, (Wardrop,) with bals. vitæ Hoffm., with *tinct. iodin.* ʒiv., *ferri iodur.* gr. xii., *antim. mur.* ʒiv., (Henderson,) and the like, as thereby dangerous symptoms, especially in old and gouty persons, may be produced, and the radical cure thereby as little effected as by extirpation, if the pressure be not removed. I have witnessed dangerous consequences after such treatment, and agree with P. Franks' warning *de clavis pedum cautè secandis.*

(*a*) Allgemein Medic. Zeitung. 1838. No. 60.

VI.—OF HORNS.

(*Cornua, Excrescentiæ Cutis Corneæ, Rhinodysmorphia corniculata,* Lat.; *Hornartige Auswüchse,* Germ.; *Cornes,* Fr.)

Journal de Médecine, Chirurgie et Pharmacie de VANDERMONDE, vol. xiv. 1761.

RUDOLPHI, Ueber Hornbildungen; in Abhandlungen der Berliner Akademie, 1814–15.

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FRORIEP; in CASPER'S Wochenschrift, 1833, p. 412.

Bulletin de la Société Anatomique de Paris, 1835, pp. 98, 114, 131.

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AINSWORTH, Dissert. de Corneis humani corporis Excrescentiis. Berol., 1836; cum tab. æneis, iv.

WÜSTEFELD; in CASPER'S Wochenschrift, 1836, p. 635.

EBERS; ——————————, 1837, p. 567.

STEINHAEUSEN; in VON GRAEFE und VON WALTHER'S Journal, vol. xxiv. p. 141.

CRUVELHIER, Anatomie pathologique, livr. 20.

2197. Horny growths of the skin, and mucous membrane, often rise several inches above the surface of the skin, and have perfect resemblance to the horns of beasts. Usually there is only one, but sometimes several at once, or near together; many even are spread over the whole surface of the body, under which circumstances the disease seems to form the transition to *elephantiasis,* where a horny substance, in shape of scales or spines, covers the whole or part of the body. These horny growths occur upon the hairy parts of the head, upon the forehead, nose, and cheeks; upon the breast, back, shoulders, arms, and hands; at the beginning of the mucous membranes, and on other parts.

Horns have been observed on the hairy part of the head by FABRICIUS AB AQUAPENDENTE, BARTHOLIN, GASTELLIER, LEX, HOME, PARKINSON, ANSIAUX, PICCINELLI, CALDANI, ASTLEY COOPER, TESTA, and by myself thrice; on the nose by myself; on the hands and feet by BORELLI, LACHMUND, DOLCEUS, DENIS, MARC, OTTO, LAGES; on the thighs by DUMARCEAU and CARRADOIS; on the face by BORELLI, RIVERIUS, FOURNIER, VICQ D'AZYR, BRESCHET, WAGNER, LORINSER, A. FRORIEP; on the eyelids by VOISIN; on the back and breast-bone, by RIGAL; on the loins and buttocks by CRUVELHIER and RIGAL; on the lachrymal caruncle by CHAVANE; on the conjunctive coat, and on the tongue, by BRESCHET; on the red edge of the lip by JAEGER; on the inside of the prepuce, on a scar, after the operation for *phimosis,* by DIEFFENBACH; on the *glans penis* by REGHELLINI, BONIOLI, CALDANI, EBERS, RICHARD-DESTRU, BRESCHET, and MECKEL. For an account of the most important early observations on such horny growth see SAMUEL COOPER (*a*).

[ERASMUS WILSON (*b*) has given an interesting statistical account of horns which have grown on the human body, having "succeeded in obtaining ninety cases; of which forty-four were females, and thirty-nine males; of the remainder the sex is not mentioned. Of this number forty-eight were seated on the head, four on the face, four on the nose, eleven on the thigh, three on the leg and foot, six on the back, five on the *glans penis,* and nine on the trunk of the body. The greater frequency of this disorder among females than males is admitted by all authors; but this fact is most conspicuously shown in the instance of the thigh and of the head; for example, of the eleven cases of horny growth from the thigh, two only were males; and of the forty-eight affecting the head, twenty-seven occurred in females, and nineteen in males; in the remaining two the sex being unmentioned. That old age is a predisposing cause of this affection, is proved by the greater frequency of its occurrence in elderly persons; thus, of forty-eight cases in which the scalp was the seat of the growth, thirty-eight were above the mid period of life; several were over seventy, and one was ninety-seven; three were young persons, and three infants." (pp. 64, 65.)

In the Museum at St. Thomas's Hospital there are three examples of horns from the

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(*a*) First Lines of Surgery, p. 346. Edition of 1840.

(*b*) Med.-Chir. Trans., vol. xxvii. 1844.

human body, two of which are those referred to by ASTLEY COOPER; the larger one, which is about ten inches long, with a base an inch in diameter, and tapering towards the tip; it grew on the upper part of a man's head, and is twisted towards its extremity somewhat like a ram's horn; it was removed, together with its root, by Dr. ROOTS, of Kingston-on-Thames, after a growth of seven years, and had been preceded by one of three inches long, which had sprung up from the scar of a tumour, of what kind is not mentioned, which had been removed, and after growing four years, fell off, or probably was pushed off, as the patient was lifting his hat from his head; leaving "the surface from which it dropped," says ROOTS, "perfectly smooth, and free from any discharge whatever. In a few months a new horn began to appear," &c. (p. 234); the horn is now in our Museum. The other horn, which ASTLEY COOPER speaks of, was from the *pubes*, about an inch in length, conical, and three quarters broad at its base and of an oval shape. The third case was a patient of my own, who had two of these horns growing from the left side of the *scrotum*; one rather larger than the other, about the size of the little finger, and two-thirds of its length; one dropped off whilst he was in the house, leaving a sore surface; and I intended removing the other, but he took fright when it was proposed to him, and went away. The Museum of the Pathological Society of Dublin possesses two horns of considerable size, which grew for six years on the upper lip of a man about sixty years of age, and were removed by PIERCE (*a*).

In the Museum of the Royal College of Surgeons of England there are two very remarkable horns, which were purchased at the sale of Sir ASHTON LEVER's collection, and marked, "supposed to be excrescences from the human head," which is unfortunately all the history of them. That they are, however, human there can be no doubt, as on the larger one a few short hairs remain, which, on examination with the microscope, presented all the characters of human hair. They are conical and slightly contracted at their base, as if they had been girt somewhat by the aperture through which they protruded; or as if a groove had been formed round them preparatory to falling off, as in the shedding of stags' horns. The larger is three and a half inches long, and the smaller only one and three quarters; but the greatest diameter of both is an inch and a quarter. The smaller one has been sawn through vertically, and presents a solid bony core, surrounded by a brownish horny substance, varying from one and a half to three lines in thickness, and so completely covering it, that all connexion between the core and any other bony part must have been impossible. The characters of the core, in all respects, even with the aid of the microscope, prove its semblance to healthy compact bone.]

2198. These horny growths are partial luxuriances of the *epidermis*, or of the mucous lining of an encysted tumour, when the horny substance is deposited in a sebaceous bag (*tumor sebaceus.*) In the *first* case, they sometimes begin without any pain or decided cause, or after some sort of irritation, as a little elevation in the skin, with branny surface, with itching, burning, or shooting. After the branny surface is thrown off, there appears a small, hard, more or less convex swelling, of a white or gray colour, which grows more or less quickly; in exact relation with its enlargement, it becomes harder, conical, shrivelled, twisted in a spiral shape, exactly like a brute's horn, from one to twelve inches long, and several inches round, is hardest at the tip, grayish or dusky on the surface, rough, and sometimes covered with hairs. In the *second* case, a nail or horn-like substance is secreted in an encysted tumour, (*tumor sebaceus*,) which bursts the skin, hardens, and protrudes in proportion as more of the substance is secreted by the tumour. When these growths have attained great size, or are periodical, at a certain time of year they are thrown off, and for the most part recur, or leave ulcers behind them.

[Of the mode in which these horns are formed from a previously obstructed follicle, ERASMUS WILSON (*b*) has given a very good description, showing how the sebaceous accumulations may become converted into horn. He says:—"From the torpid action of the skin, or from the nature of the contents of the cells, or from both causes together, the sebaceous substance collects within the follicle, becomes impacted, and acquires an abnormal degree of density. In this situation the impacted mass exerts so great an

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(*a*) Dublin Journal of Medical Science, vol. xvi. p. 329. 1839.

(*b*) Above cited.

amount of pressure on the vascular walls of the follicle as to abrogate its special function, and the peculiar elements of the sebaceous secretion, cease to be produced. The formation of *epithelium*, however, still continues, and layer after layer of epithelial scales are developed, until the mass acquires considerable size. Tumours of this kind, from the nature of the position of the sebaceous follicle, namely, within the *corium*, rarely acquire a large size as compared with tumours in other situations. They are prevented from pressing inwards by the deep stratum of the *corium;* the same structure opposes their increase outwardly or laterally. Nevertheless, I have seen a tumour of this kind, which measured three quarters of an inch in diameter, but not more than a quarter of an inch in thickness. The aperture of the follicle remains open, and is more or less distended in proportion to the extent of the tumour; but from the nature of the collection, there is no tendency to its escape. I have called such tumours *sebaceous accumulations.* Certain minute tumours, commonly met with in clusters, around and upon the eyelids, *sebaceous miliary tubercles*, are of the same pathological nature with the sebaceous accumulations, but in these the excretory follicle is closed. The peculiar pathological character of the tumours just described, is their laminated texture, and the identity of structure of their contents with *epidermis*, most, if not all, of the peculiar constituents of sebaceous substance being absent. * * * If now, in the cases above recited, we imagine the upper wall of the laminated tumour to be removed, and the accumulated substance exposed to the influence of the atmosphere, any moisture retained by the epithelial *laminæ* would soon become dissipated, and the whole mass would acquire the consistence and hardness of *epidermis* of equal thickness; in other words, it would be converted into horn. Such a case as I am now supposing, does sometimes in reality occur. The aperture of the follicle acquires an unusual degree of dilatation, and some of the hardened contents of the tumour are pressed through the opening. By the addition of fresh layers from below, (the formative power having increased by the removal of superficial pressure,) the indurated mass is still further forced outwards, dilating the aperture as with a wedge, and finally increasing its size to that of the entire base of the hypertrophied follicle. The process of formation of new epithelial layers by the walls of the follicle (now become the base of the mass) will go on, unless interrupted by surgical means, for years, and in this manner those singular bodies, of which so many examples are on record, *horns*, are produced." (p. 57-59.)]

2199. The proximate cause of these growths is a perverse and increased secretion of the vascular net of the skin, of the mucous membranes, or of the internal surface of encysted tumours. They are most usually produced in persons of advanced age, and their immediate cause is continued irritation of the skin, or of the mucous membrane by kicks, blows, chafing, wounds, scars, eruptions on the skin, and the like; or they are in causal relation with suppressed menstruation, rheumatism, and gout, or rickets. Most cases, however, show that persons affected with these growths are in otherwise sound health; and even when they are thrown off, there is usually no disturbance of the constitution.

Mercier (*a*) distinctly observed in a growth of this kind, which was an inch high and an inch and a half round its base, hard and dusky, from its base to its tip, that it was formed of fibres converging from the base to the tip, and which at bottom were separated by fat, so as to have the appearance of ordinary fibrous tissue. The fat diminished, and the fibres becoming closer towards the tip, were mostly grayish black, and extremely hard; they were also less soft and white as they approached the surface. They were easily separated at the root, and were continuous with the fibres of the skin, which from the fact of vessels being also present, led him to believe that they were not true hairs, but merely a degeneration of the fibrous tissue. Mercier supposed it connected with the skin, and that its hardness depended on the evaporation of the fat and intermediate fluid. According to his notion, some horns are not the result of diseased secretion, but of *actual transformation of the skin.* Hairs may however exist in such horns, just as in encysted swellings, but the horn must not therefore be considered to be formed of conglomeration of hair, as supposed by some persons.

2200. Examination of these horny growths proves that their base is formed of a soft tumour, and their root usually, in mucous membranes more particularly, consists of a lardy, vascular tissue, similar to the *matrix*

(*a*) Bullet. de la Société Anatomique de Paris. 1835, p 114–131.

of a nail (JAEGER); upon this is a substance composed of parallel fibres, which increases in hardness and density near the surface and tip; the fibres are fewer towards the centre, and separated by a soft fatty mass, which is in greatest quantity at the root. The density and hardness of the growth are in direct relation with its dark colour; both are least in the middle and towards the base. These growths are held to be identical with the substance of nail, and the spurs of gallinaceous birds, which is confirmed by chemical examination, being composed of the same substances as the horns of beasts, excepting the antlers of deer, which contain more than a fourth of their weight of gelatine, and have oxygenated albumen as their principal element. Their colour, hardness, and transparency depend on the carbon, phosphate of lime, and glue-like substance which they contain (JAEGER.)

2201. In their *treatment*, their cause must be removed by proper remedies, preparations of antimony and quicksilver, by baths, decoctions of woods, ZITTMANN's decoction, and the like. It has been noticed that they drop off, under the use of purgatives. If this do not however happen, the sound skin must be divided by two semilunar cuts, and the horn with its root extirpated, in doing which everything in and beneath the skin, which has degenerated, and is discoloured, or suspicious must be carefully removed. With this object it may be advisable even to cauterize the wound, so as to produce an issue, and to employ proper after-treatment. The merely cutting short these growths, by sawing or filing, in general causes their increased growth; and also tearing them out, when the connexion of their root is not very great, is objectionable on account of the pain and the uncertain results.

VII.—OF BONY GROWTHS.

(*Tumores Ossium*, Lat.; *Knochenauswüchse*, Germ.; *Tumeurs des Os*, Fr.)

MATANI, Observationes de Ossium Tumoribus. Colon., 1765.

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DIETEL, Comment. Anatom. Pathol. de Osteosteatomate. Lips., 1822.

MIESCHER, De Inflammatione Ossium. Berol., 1836. 4to.

RICHTER, A. L., Die Organischen Knochenkrankheiten. Berlin, 1839.

Also the general observations on Diseases of Bone, by PETIT, DUVERNEY, PALLAS, BOETTCHER, BERTRANDI and CLOSIUS.

2202. Bony growths form swellings of greater or less extent, which arise from the surface or interior of the bone, and in which the texture of the bone either remains natural, or the enlarged bone becomes unusually firm, hard, ivory like, or loosened up, spongy, and partially converted into a fleshy or lardy mass. According to these various conditions are distinguished *true bony growths*, (*exostosis*,) bone-flesh or bone-lard growths, (*osteosarcoma*, *osteosteatoma*,) and *spina ventosa*.

2203. These diseased changes of bone may originate in the *periosteum*, in the bony tissue itself, or in the medullary membrane. Their general origin is an inflammatory condition of the *periosteum*, of the medullary membrane, or of the membrane lining the bone-cells, which swell by the larger deposition of the juices, and secrete a plastic matter, which by the laws of the natural growth of bone, is converted into bony substance. Or there is an unnatural growth of the bony tissue, or there is produced in the cells, a fleshy, lard-like or gelatinous substance, which absorbs the mass of the bone, and converts it wholly or in great part into a lardy or fleshy substance. The causes exciting this inflammatory condition, are either external violence or dyscrasic diseases, especially *syphilis*, scrofula and gout. According to the chronic or acute character of this inflammation, and the variety of the causes on which it depends, does the course and issue of this diseased change of bone vary.

2204. *True Exostosis* (*Exostosis proprie sic dicta*, Lat.; *eigentliche Knochenauswuchs*, Germ.) is a more or less circumscribed tumour arising from a bone, and depending on an unnatural increase of the bony substance. This tumour is sometimes confined to one part merely of the bone, and attached to it by a thin neck or by a broad base; at other times, it springs up without any definite boundary; and sometimes occupies the whole extent of the bone, under which circumstance in tubular bones, the medullary cavity is in general lessened, or completely destroyed. Some *exostoses* consist of a great development of the bony tissue itself, arise from the medullary membrane, or from the cellular structure of the bone; some form over its whole extent, between the bone itself and the *periosteum*.

According to Jaeger (*a*), *exostosis* never arises from the interior substance of the bone, but is attached firmly to its external surface; between it and the *exostosis*, a fine line of the shell of the bone forms the boundary; this is gradually absorbed, so that the cells of the *exostosis* are partially, or completely connected with those of the bone. But the *exostosis* which is developed between the *periosteum* and the bone, is oftentimes the consequence of a natural secretion of the bony tissue itself, and spreads from the interior towards the exterior of the bone. In this case the *periosteum* is only secondarily changed, and the tumour seems like a wedge sunk into the substance of the bone, is commonly hard, and like ivory. The substance of the mother-bone is compact, hard and ivory-like to a greater or less depth. In other instances the tumour springs from the *periosteum* itself, in consequence of inflammation of its substance; sometimes a plastic exudation takes place on its inner surface, which becomes bony at the same time, and in the same manner as in the natural formation of bone. Sometimes these deposits are separated by the internal plate of the *periosteum*, and are then more or less movable upon the bone itself; at other times they are firmly attached to the bone, which itself exhibits no change. These *exostoses* are generally cellular, and rarely ivory-like. They are not unfrequently noticed at the seat of encysted tumours, which by their pressure have given rise to them. (Pigné.)

2205. The internal condition of *exostosis* varies; sometimes if the swelling be not large, and lie on the surface of the bone, a net-work of bony fibres is observed, in the interspaces of which a new mass of bone is

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(*a*) Handwörterbuch, vol. ii. p. 507.

deposited; sometimes the interior of the swelling presents rather a laminated structure, sometimes the hardness of the *exostosis* is greater than that of the healthy bone; it presents in its interior a regular compact mass like ivory, and is either smooth upon its surface or has distinct studdings.

To these must be certainly considered to belong those bony tumours which ASTLEY COOPER has described as *Cartilaginous Exostosis of the Medullary Membrane;* SCARPA (*a*) as *Exostosis maligna;* OTTO (*b*) and VON WALTHER (*c*) as *Osteosteatoma;* JOHN MÜLLER (*d*) has described it most minutely in all its relations, as *Enchondron* (*Sarcoma cartilagineum, Tumor cartilagineus.*) He speaks of a good kind of swelling of the bone, or even of the soft parts; for instance, of the glands, which form a spheroidal tumour, not lobulated, and acquiring the size of a fist, or larger. When in the soft parts it has a thin covering of cellular tissue, but in bone, where it occurs most frequently, it appears like a soft expansion of the bone overspread with *periosteum*, the expansion being either developed from within, with a bladder-like expansion of the thinned shell of the bone; or more rarely it appears to be produced from the exterior of the bone, and then is not necessarily enveloped in a bony shell. In the former case the bladder-like expansion of the *periosteum* forms a sort of shell, enclosing the soft mass; sometimes there are merely single, isolated, insular, thin patches of bone. The joint-surfaces of the bone are generally in this disease either not at all or but little changed; even when a phalanx of the finger enlarges to a tumour of the size of a lemon and round, the joint-surfaces usually continue natural. The parts over the swelling in general remain unaltered, although they be much expanded. Now and then the slow painless development of the tumour, as well as the constitution continuing healthy for ten or twenty years, lead to the notion that the swelling is not malignant. The contents of the tumour are soft, in and upon the bone in general, with interwoven projections of spongy substance, which, however, may be entirely deficient. The *parenchyma* of the tumour usually presents, on being cut into, two elementary parts, distinguishable with the naked eye, of *fibro-membranous*, and a gray slightly transparent substance, *similar to cartilage or tough jelly.* The fibro-membranous part, which is rarely wanting, forms small or large cells, of the size of peas, or larger; and in the larger, smaller cells are often developed. In their cavities is a grayish, rather transparent substance, distinguished from cartilage by its softness, and rather resembling the soft hyaline, or glass-like cartilage, existing in some fishes, and sometimes even like tough jelly. This substance may be easily shelled out of the cavities, and can be readily broken up. When put in spirit of wine it still retains its slightly transparent character. The more transparent cartilaginous substance is massed together by partitions of membranous structure, and such conglomeration is peculiar to the *enchondrom*, and does not occur in other swellings of bone. If the mass seem free on the surface little elevations are noticed, which show the conglomeration externally. Microscopic examination shows that the fibro-membranous part consists of transparent net-like fibres; the glassy mass completely resembles cartilage, and exhibits oval, round, semi-transparent cartilaginous corpuscles spread about in it. After boiling from ten to twelve hours, the *enchondrom* of bone gives out a considerable quantity of gluten, which, on cooling, becomes well gelatinized, but in its chemical properties is entirely different from common gluten *colla*, but on the contrary, agrees with the peculiar gluten of cartilaginous fishes, the *cartilage gluten*, or *chondrin*, described by MÜLLER. The chemical examination of the *enchondrom* of soft parts presents a difference, as on boiling the common chondrin, but then even no chondrin contains, on the contrary, a considerable quantity of jellying gluten. Usually the existence of *enchondrom* proceeds from external causes, as bruises and the like, and this happens most commonly in childhood. I have, however, seen it in the metacarpal bone of the thumb of an aged man, in whom it first arose at a late period, and whose cure was permanent after its extirpation. A general cause of the disease is ordinarily not to be found, although tumours of this kind often occurring in different parts may lead to such conclusion, but the cure is usually permanent after amputation. I have noticed this also after the removal of an *enchondrom* of the testicle, and in the upper third of the upper arm. The development of *enchondrom* is in general without pain, and may so arise and continue increasing for a long while. If from any cause inflammation be set up in the swelling, it proceeds to suppuration, the swelling bursts, and the bone becomes necrotic.

(*a*) De Expansione Ossium, &c.; in his De Anatome et Pathologiâ Ossium Commentarii. Ticini, 1827. 4to.

(*b*) Neue Seltene Beobachtungen zur Anatomie, Physiologie, und Pathologie gehörig, p. 22 Berlin 1824.

(*c*) Journal für Chirurgie und Augenheilkunde vol. xiii. part iii.

(*d*) Above cited, p. 31.

An interesting case of extirpation of the finger with its metacarpal bone, at the *carpus*, is given by WALTHER (*a*). MÜLLER (*b*) has also collected the various observations on *enchondrom*, and it has also been written on by J. HERZ (*c*).

2206. *Exostoses* may arise in all bones, but they most frequently appear on the compact parts of tubular bones, and on flat bones, in the middle of the thigh, of the shin-bone, the upper-arm-bone, the *radius* and *ulna*, and on the bones of the skull, but rarely in the neighbourhood of the spongy joint-ends of bones. The *proximate* cause of *exostosis* is a change of the nutritive process of the bone from inflammation, in consequence of which a large quantity of phosphate of lime is deposited in the bony tissue, and upon this its enlargement depends. The time required for its development seems correspondent with that for the natural formation of bone and *callus*, as its substratum is at first soft, and only at a later period hardens. The *occasional* causes which bring about this inflammation are, as already generally noticed, either external violence or internal disease, especially *syphilis*, gout, and scrofula. There may be so remarkable predisposition to *exostosis*, or an increasing deposit of bony substance, that very inconsiderable external violence may favour its formation (*d*). *Syphilis* in general produces, especially as consequence of inflammatory affection of the *periosteum*, superficial *exostoses* or *nodes*, (*Gummata*, *Nodi*, *Tophi Venerei*,) and most readily in bones little covered with soft parts. Scrofula more commonly gives rise to the *exostoses* which are seated deeply in the bony tissue.

I have observed a similar predisposition to *exostosis* in an otherwise healthy and strong young man.

2207. The symptoms which accompany the origin and further development of *exostoses* vary according to their cause and nature. Sometimes they occur with more or less distinct symptoms of inflammation; sometimes, however, without any pain. If the *exostosis* depend on *syphilis*, it is nearly always preceded by severe boring, or gnawing pain, setting in especially towards night, which at first spreads over the whole bone, but afterwards fixes on the point where the *exostosis* forms. In scrofulous exostosis the pain is duller and less severe: this is, however, in general the case, if the exostosis arise after external injury, when the pain usually soon subsides, and the swelling is so imperceptibly developed that it is commonly only first noticed when it has acquired some size. *Exostosis* principally forms either slowly or quickly; in the former case the structure of the growth is usually very firm and the pain slight, in the latter the pain is very severe, the swelling grows quickly, and is often accompanied with violent fever. Sometimes the pain, which had existed at first, subsides during the progress of the disease. Not unfrequently the swelling remains at a certain size, without further increasing, and without causing other symptoms than those produced by its seat and pressure upon the neighbouring parts, to wit, a displacement of the muscles, disturbance or loss of motion of the part, wasting, paralysis, and the like: such is especially the case in firm idiopathic *exostosis*, which has been slowly developed. Less firm *exostoses* may run on to ulceration and ill-conditioned ulcers. A rare termination of *exostosis*, especially of the firm kind, is its complete separation by *necrosis*.

2208. The *diagnosis* of *exostosis*, in reference to its original causes, to

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(*a*) Above cited.

(*b*) Above cited.

(*c*) Dissert. de Enchondromate. Erlangen, 1843.

(*d*) ABERNETHY, quoted in SAMUEL COOPER'S Surgical Dictionary, p. 515. Edit. of 1838.

the substance forming it, and the part of the bone where it has been originally developed, is founded on the following circumstances. Idiopathic is distinguished from syphilitic, and scrofulous *exostosis* by the previous violence, and by the absence of the symptoms which syphilitic or scrofulous disease manifests. Syphilitic *exostosis* is always accompanied by the symptoms of general and inveterate *syphilis*, with nightly pains of the bones, is mostly situated in bones covered with little soft parts, and usually arises on the surface of the bone. Scrofulous *exostosis* is accompanied with the general symptoms of scrofulous disease, and is mostly situated in the deeper bony tissue and the spongy joint-ends of bones. Slow development of the *exostosis* leads to the expectation of a firm, ivory-like nature; whilst a quicker progress, accompanied with much pain, points to a less firm structure. These symptoms are not, however, certain. When ulceration has taken place, it may be ascertained with the probe, or with the finger, from the condition of the parts.

2209. The *prognosis* of *exostosis* is in general unfavourable; it is most favourable, however, in the idiopathic kind, if it acquire a certain size, remain stationary, and is only inconvenient by its size and weight. Syphilitic and scrofulous *exostoses* are always accompanied with a high degree of constitutional ailment; they may pass into malignant ulceration, which wastes the powers.

2210. The *treatment* is guided by the various causes and condition of the swelling. If *syphilis* or scrofula be at its root, the remedies opposed to these must be employed. If the pain be considerable, leeches, rubbing with mercurial ointment and opium, softening poultices with opium, and the like. The dispersion of a true *exostosis* is never to be expected from the various dispersing remedies which have been recommended for external use, as hemlock, mercurial, and ammoniacal plaster, Schmucker's plaster, rubbing in volatile salves, long-continued blistering; they may rather, by their irritation, set up inflammation in the skin, increase the pain, and even encourage the enlargement of the swelling. In general the progress of the disease is not arrested either by general or local treatment. When these remedies have actually dispersed bony swellings, they were doubtless only inflammatory swellings of the *periosteum*.

2211. In idiopathic *exostosis*, the further increase of the swelling may, perhaps, at the onset, be prevented, by bloodletting, and the continued use of cold applications, and afterwards by dispersing remedies; its size may also, perhaps, be diminished.

2212. If the *exostosis* be void of pain, if it do not enlarge, nor inconvenience the patient, or if situated on any part where mechanical treatment is improper, it is advisable to let it alone. But if the swelling be very inconvenient to the patient, and if its situation admit of mechanical treatment, the only remedy is its removal. This requires the exposure of the swelling by a crucial cut, or by two semilunar cuts at its base, and its separation with a fine saw, or with a chisel and hammer. If the *exostosis* be firm and large, it must be removed piecemeal; a horizontal cut with the saw being met by a vertical one. The treatment of the wound consists either in bringing together its edges, if the part whence the swelling has been removed be sound, or in the application of a mild dressing, as has been described in wounds of bone with loss of substance. If the size of the swelling permit not its removal, amputation of the limb must be performed.

In most cases the removal of *exostosis* is best effected by Hey's, Machell's (*a*), or Graefe's (*b*) saw, and Heine's bone-knife.

When the position of the *exostosis* will not permit its removal in the above manner, instead of proceeding to amputation, its absorption should be encouraged by removing the *periosteum* from the swelling, in consequence of which its vessels are pulled out. This plan of treatment is at least recommended by Astley Cooper (*c*).

On the side of the nail, especially of the great toe, tumours not unfrequently arise which are hard and immovable, covered with a glossy skin, their interior as hard as the bone from which they arise, and they are mostly seated on a broad base. They cause considerable inconvenience in walking; after extirpation they soon recur, and the only remedy is the removal of the whole phalanx.

2213. *Osteosteatoma* and *Osteosarcoma* (*Knochenspeck und Knochenfleisch-Geschwulst*, Germ.) and *Spina ventosa* (*Winddorn*, Germ.) must be considered as allied diseased conditions, inasmuch as in both there is an enlargement of the bone deviating from its natural condition, with which its nature is completely changed and converted into a fungous, fleshy, jelly- cartilage- fibre- medulla- fat- or lard-like substance, in which are found larger or smaller pieces of bone of various shape.

2214. The *causes* of *osteosteatoma* and *osteosarcoma* are partly external, partly internal; to the former belong violence of all kinds; to the latter, an ill condition of the juices, venereal, scrofulous, rheumatic, and gouty diseases. Boyer and others suppose that *osteosarcoma* is of similar nature to carcinomatous degeneration of soft parts, and support this opinion especially by cases in which, after the removal of the disease, or after amputation of the limb affected with it, the same disease has taken place in other parts. According to my view, such cases must be considered as medullary *fungus* of bone.

The formation of *osteosteatoma* and of *osteosarcoma* is always preceded by an inflammatory condition, the cancellous membrane swells up and thickens, the cells of the bone expand, the membrane lining them produces fungous growths, the nourishment of the bone is so changed, that there is no longer any deposit of phosphate of lime, but a flesh- or lard-like, or other kind of substance, is produced. If such bone be subjected to maceration, nothing remains but the partially-expanded cells of the bone, the walls of which are exceedingly fragile. The formation of *osteosteatoma* and *osteosarcoma* proceeds, although, most frequently, yet not alone, from the *periosteum*, as supposed by many, but also from the whole bone. Its firm connexion with the *periosteum* does not contradict this, as close connexion with the *periosteum* occurs in all irregular formations of bone.

2215. The substance of which *osteosteatoma* and *osteosarcoma* consists, is various; sometimes homogeneous, lard-like, similar to a scirrhous gland; the cells of the bone are much expanded, and filled with fungous growths, sometimes pap-like, gelatinous, and brain-like at certain parts; sometimes the tumour forms a hollow ball with firm walls, and its interior is filled with painless, sponge-like granulations.

2216. The *symptoms* accompanying *osteosarcoma* or *osteosteatoma*, are not distinguished from those of *exostosis*. In most cases the disease is preceded by a deep-seated pain, which at first is slight and remitting, but subsequently fixed to the spot at which the swelling appears. As the substance grows, the pain in it usually becomes severe and lancinating;

(*a*) Astley Cooper, above cited, pl. xv. figs. 7, 8.

(*b*) Schwalb, Dissert. de Serrâ orbiculari. Berol., 1819.

(*c*) Above cited.

(*d*) R. Liston, On the Cure of Exostosis of the last Phalanges of the Toes by excision of the Diseased Bone; in Edinburgh Med. and Surg. Journal, vol. xxvi. p. 27. 1826.

the skin is tense, sometimes inflames, at last bursts, hectic fever is set up, and the patient's powers are broken up. The ulceration may run into a cancer-like ulcer. Many differences, however, present themselves in the progress of *osteosarcoma* and *osteosteatoma;* the pain is sometimes very severe at the onset, and diminishes or entirely subsides afterwards; sometimes the disease remains in one definite state, and the pain ceases; sometimes the pain prevails with equal severity from the beginning to the end of the disease. It is self-evident that from the situation of the disease, from its spreading, and from the neighbourhood of important organs, symptoms may be produced.

2217. The external condition of the tumour varies; sometimes it is confined by well-marked bounds to one part of the bone, sometimes it involves the whole bone. In general, *osteosteatoma* and *osteosarcoma* have no precisely defined limits, but are gradually lost in the neighbouring parts; the swelling does not entirely resist the pressure of the finger, but shows rather some elasticity, and at several parts a seeming fluctuation, by which it is distinguished from *exostosis.*

2218. The *treatment* of *osteosteatoma* and *osteosarcoma* precisely agrees with that of *exostosis.* At first, if merely pain be present, remedies opposed to the cause of the disease must be employed, in connexion with blood-letting, cold applications and the like upon the affected part, for its somewhat possible prevention. These are the only remedies which can be employed for its control, when the swelling has already made some progress; however, usually, no advantage is thereby gained, and time is merely lost in the progressive increase of the swelling. The alone remedy, if the seat and condition of the disease permit, is the removal of the swelling with the saw, or with the chisel and hammer, or the amputation of the limb if tumour have attained considerable size, or the whole bone be affected. Where possible, the amputation should be performed above the next joint.

The *prognosis* always remains in other respects doubtful, because in most cases the disease again shows itself on the scar, or on some other part.

2219. *Spina ventosa* or ***Pædarthrocace*** (*Winddorn*, Germ.) is a swelling partially or entirely occupying the whole extent of the bone, tolerably equal and regular, in which the nature of the bony tissue is in various ways conditioned. Sometimes a regular, firm bony crust, which is perforated at different parts, forms the exterior of the swelling, in the cavities of which a cartilaginous mass is found with irregular, isolated or attached bony growths. Sometimes the external wall of this swelling is formed merely of very much expanded *periosteum*, and the substance within, as in the former case. Sometimes the interior contains one or several cavities, filled with variously coloured ichorous fluid, a reddish gelatinous substance, or with decomposed and clotted blood. In the walls of these cavities is found sometimes a cartilaginous, sometimes a lard-like substance, sometimes necrosed or carious pieces of bone, which must be considered partly as the remains of the destroyed original bone, and partly as a new production (*a*).

2220. This disease always declares itself a longer or shorter time before the swelling appears, by dull deep pain in the bone, which is set up either of its own accord, or after some external violence. The swelling appears either as a conical or spherical knob, or as a regular swelling, including

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(*a*) Delpech, Précis Elémentaire, vol iii. p. 583.

the whole circumference of the bone. The pain is of varying severity, and often increases to a very considerable degree as the swelling increases. The soft parts surrounding the bone swell up, the skin becomes painful, red, thins at the most elevated parts, bursts and discharges an ichorous fluid. The edges of the ulcerated aperture thin and drop inwards, whilst the rest of the swelling retains its size and consistence. A probe passed through this opening can with ease be carried deeply in every direction, penetrating the cartilaginous substance, and but little arrested by the fragile pieces of bone. From the discharge of the juices, and the absorption of the ichorous fluid hectic symptoms arise at an earlier or later period; fungous excrescences spring out of the apertures, are exceedingly sensitive, bleed easily, and increase the exceedingly severe pain.

[Our celebrated countryman, Richard Wiseman, has given (*a*) a very excellent description of *Spina ventosa*, of which he says:—" It hath been taken notice of by very few authors, and I myself succeeded happily in the curing those in the lesser Bones, many years before I knew what name to call the Disease. And in truth I do not now greatly approve of the name, but shall acquiesce in it and represent it to you, as I have frequently seen it in my Practice in the *King's-Evill*, it being a certain *species* of that Disease, and of no other that I ever saw. It taketh it's beginning from a thin acid *serum* in the medullary juice, which corroding the Fibres maketh a solution of continuity there, and at length corrupteth the interior part of the Bone, and at last (if not prevented) corrodes the Shell, and passeth it's subtill Humour through some porosity it had made. This Disease of the interior part, by degrees usually so affecteth the externall Shell of the Bone, as to raise it to a preternaturall Tumour, which, at the same time, overstretching the *Periosteum* causeth an uneasiness; and this Pain if it grow so acute as to produce Inflammation, an Abscess consequently followeth. If the Bone be spungy and soft, it is wonderfull to see how quickly the Fibres of it will be mollified by the influence of the *serum* of the Blood, and made apt for a sudden Distension, as if the part were rather musculare than Bone. So in childrens Fingers, I have seen a Bone swelled in a night, and the like Tumour raised in the spongy Bones of elder persons in few days, without much difficulty to yield again to exsiccant Remedies. Yet it sometimes happeneth, that the interior part of the Bone is totally corrupted without any externall Tumefaction or Pains, till the acid Humour maketh its way through the *cortex*, and eroding the *Periosteum*, causeth a solution of continuity there; which by access of pain swelleth and inflameth the externall Parts, and produceth Maturation in few days. Those in the protuberant Bones do also frequently raise Abcesses after the same manner, and sometimes whilst the exteriour Parts suffer under another Ulcer different from this. Somewhat of their Differences I have showed you in the preceding lines, others may be taken from the Quality of the *serum*. In some there is a sudden Tumour raised in a night, in others it swelleth gradually, and never corrupteth externally. In others the Humour pierceth through the *cortex*, and raiseth suddenly an Abscess. And these Differences may be said to arise somewhat from the Place or Bone they affect: for, accordingly as the interiour part of it is softer or harder, or the externall *cortex* is solid or porous, so it suffers Solution sooner or later. Those of the *cranium* for the most part pass their way through the interiour *lamina* and affect the *dura mater*, &c., producing great Pains, Convulsions, *Spasmus*, Epilepsies, and they die before the Disease is discovered. In the great Bones of the Knees, Ancles, Elbows, &c., they pass their Matter slowly, and are more generally diseased with Apostemations, externally arising from the protuberance of them. In the *Os tali* or Heelbone, which is spungy within, and full of externall pores, they make their way through more suddenly, and so accordingly they do in the Jaws, Fingers and Toes. The cause of the *Spina ventosa* I have already delivered you in short to be the Acid quality of the *serum sanguinis* in the Bone. The most visible Signs of it are a protuberance of the Bones without discolouring of the Skin, and often without Tumour or Pain. The Apostemations proceeding from the *Spina ventosa* do most certainly shew them, they rising always between the Membranes and Tendons, and somewhat of Fluctuation may be felt there before the externall Skin be considerably inflamed: also if upon Opening it you make search with a Probe, you will find it penetrate deep into the Bone, yet is the *cortex* of it white; whereas the other Abscesses do always begin externally, and if the Bone be bare, yet is it only superficially carious or stained by the

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(*a*) Severall Chirurgical Treatises. London, 1676. fol.

Matter. The Cure of the *Spina ventosa* in the lesser Bones, as the *Cranium*, Jaws, Fingers, and Toes is feasable; but those in the bigger Bones are for the most part deplorable. Infants and Children are generally the subject of this Disease." (pp. 262, 63.)]

2221. The ground of *Spina ventosa* lies in an inflammation and ulceration of the medullary membrane of the bone, upon which depends the destruction of the bone from within outwards. The most common *cause* of this complaint is scrofula, although also *syphilis*, gout, *rachitis*, scurvy, small-pox, and the like, as well as external violence, particularly bruises, and concussions may give rise to it. The tubular bones, especially the metacarpal, metatarsal, and finger bones, are most frequently attacked by this disease; but very rarely are the short and spongy bones, as the carpal and tarsal affected with it. The degeneration of the spongy ends of bones, which has been considered with the different affections of the joints, (*par.* 221,) may indeed be placed, together with *Spina ventosa*, in the compact structure of tubular bones. In most cases, especially in the finger and metacarpal bones of scrofulous persons, *Spina ventosa* consists in tubercular formation in the bone, and according to the degree of softening in the tubercular mass, does the nature of the contents of the swelling vary. Hence the death of the bone is caused to a definite extent, and on its throwing off does the cure first commence. In this disease, ordinarily, no new bone is produced, probably because the *periosteum* and the medullary membrane of the bone are destroyed. Hence also the bone, after the cure of the disease, is considerably shorter, and the corresponding finger drawn backwards.

2222. From the symptoms which accompany the development and further progress of *Spina ventosa*, the distinction between it and *exostosis*, *osteosteatoma*, or *osteosarcoma*, must, in many cases, be very difficult. *Spina ventosa* may indeed be distinguished from *exostosis*, inasmuch as it involves the whole circumference, whilst *exostosis* is more circumscribed and confined to one definite part of the bone; the irregularities, however, which *Spina ventosa* at first exhibits, and the thickness of the soft parts covering it, render the certain knowledge of the difference between them very difficult. In regard to external form, *Spina ventosa*, for the most part, agrees with *osteosteatoma* and *osteosarcoma;* its development, however, is in most cases more tedious than in both those diseases, and the pain is more severe and constant.

2223. *Spina ventosa* is a disease of importance, slow and difficult to cure, and proportionally more so when attacking adults. In general its *treatment* corresponds at the commencement of the disease with that already directed for *exostosis*, *osteosteatoma*, and *osteosarcoma*. Suitable remedies must be employed to counteract the internal causes, and the great hope in young persons, when the disease has originated in scrofula, rests on the use of antiscrofulous remedies; and by the often occurring total change of the constitution, at the period of puberty, the cure may be brought about, under which circumstances the necrosed pieces are thrown off from the diseased bone, and the fistulous openings close. Poultices of aromatic herbs, of decoction of savine, baths of camomile, of hemlock, and the like, serve for local applications If the tumour have burst, aromatic baths and poultices must be employed, and a free outflow given to the pus. For assuaging the very severe pain, frequent poulticing with hemlock, sometimes with the addition of opium, must be employed; but if the disease have reached such degree that the powers of the patient are failing under hectic symptoms, amputation is the only hope. Laying bare, boring holes in the bony tumour, as also the application of acrid remedies, or even of the actual cautery, for the destruction of the diseased bone, are improper.

The *formation of tubercles in bone*, which has been referred to in various places, as in spondylarthrocace and *Spina ventosa*, and indeed pointed out by the older writers, (GALEN, SEVERINUS, GERBER, HANCKE,) has been more carfully described by DELPECH and NEIBERT, but especially by the attention which the Anatomical Society of Paris have given to the subject (*a*), and by NELATON's clever treatise (*b*), it has been carefully set forth. Of this treatise PIGNÉ has given an abstract in his French Translation of this work, which I the more readily here repeat, as it confirms many of my own earlier statements.

The *causes* of tubercular formations in bone are those of tubercle in general. Most commonly it appears in childhood, although it is often enough noticed in adults. All the bones may be attacked with it, though the several bones may be arranged in the following way, according to the frequency of its occurrence in them; the *vertebræ*, the shin-. thigh- and upper-arm-bones, (in children,) the fingers, metacarpal and metatarsal bones, the breast-bone, ribs, iliac bones, the petrous portion of the temporal bone, and the short carpal and tarsal bones. The disease appears under two forms; the tubercular mass is collected in one or several cavities, in the middle of the bony substance (*tubercula cystica*, Lat.: *tubercules enkystés*, Fr.); it may be infiltrated into the cells of the bone (*Infiltratio tuberculosa*, Lat.; *infiltration tuberculeuse*, Fr.)

A. The encysted tubercles appear during their progress in five stages (*c*):—

1. *Gray Granulations* (*Granulations grises.*)—At the top of the affected part of the bone from which the *periosteum* has been removed, some vascular points are observed, forming violaceous marblings, and sometimes slight elevations which deprive the bone of its regularity. If layer after layer of the compact part of the bone be first removed, and afterwards its cellular tissue, a substance is reached of many lines in extent, formed by the union of little pearly granulations, half a line in diameter, of a white opaline colour. Many of these granulations, specially such as are at the periphery, are encircled by a little bony shell of very great tenuity and transparence. It is not uncommon to find some of these granulations, which present in their centre a yellow opaque spot, indicative of commencing transformation; in the interstices separating them some exceedingly delicate vessels creep, which inosculate with those of the surrounding bony tissue, upon which a very distinct injection is perceived. The surface of the bone, at the nearest point of this tuberculous deposit, is often doubled by a bony layer of recent formation. These granulations exhibit complete identity with those generally regarded as rudiments of pulmonary tubercles; they are pretty frequently met with on bones, which on other parts of their extent exhibit well-developed tubercles; and the lungs of persons in whom they are met with generally contain tubercles. The bony partitions which separate each of these granulations are not slow to be absorbed and disappear entirely, and then occurs the second period.

2. *Crude, encysted Tubercles* (*Tubercules crus, enkystés.*)—These granulations being united into one single mass, lose their primitive colour and appearance; the vessels and partitions which separated them have disappeared: there is soon merely an opaque-white mass, inclining to yellow, like that of putty, without any elasticity, and retaining the impress of the finger; it is homogeneous, contains no bone, and presents sometimes slight marblings, more white, or slightly gray. This matter is contained in a cyst, which lines all the anfractuosities which the tubercular cavity presents. This cyst, which has but little thickness, is at first gelatinous, transparent, but ends in acquiring considerable resistance, and contains vessels more and more numerous as the tubercle increases in softness. The bony cavity is more or less regularly rounded, sometimes angular, and forming many adjacent cavities, which open into the central cavity. Its surface, though generally smoothed, presents sometimes a heap of little bony needles of exceeding delicacy, almost all parallel, and directed towards the centre of the cavity. At other times, instead of being entirely bony, these walls are formed of bony, fibrous and cartilaginous tissue; when, in consequence of its development, the tubercle has reached the surface of the bone, when it is immediately beneath the *periosteum*, the latter becomes hypertrophied and adheres strongly to the cyst. For the rest, the bony tissue which bounds the excavation has preserved its natural density and texture; all the parts

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(*a*) Bulletin de la Société Anatomique de Paris. August and November, 1837; May and July, 1838.

(*b*) Recherches sur l'Affection Tuberculeuse des Os. Paris, 18 7.

(*c*) I have translated this abstract from PIGNÉ.—J. F. S.

invaded by the tubercle, instead of being crowded together by it, are destroyed as it were by a punch. These tubercular collections have an extent varying from two to three lines in diameter, up to fifteen and twenty; they are generally not very numerous, and it is very common to find only one pretty large one, and many of small dimensions. When a tubercle is developed in a bone, its *periosteum* becomes more vascular, as also the bone at the point nearest the accidental production. This vascularity is soon followed by the deposition of layers of newly-formed bone; besides, tubercles developed near the extremity of a bone, open more easily into the cavity of the joint than on the surface of the bone; and this may be imagined, inasmuch as having traversed the entire primitive bony tissue, the tubercle has still to traverse the bony layers of new formation, whilst towards the joint no such analogous obstacle is met with.

3. *Softened tubercles* (*Tubercules ramollis.*)—The more slowly the matter contained in the cyst softens, and so soon as the softening operates regularly from the centre to the circumference, so soon does it proceed from one part of the periphery to propagate itself to the whole mass.

4. *Eliminary process* (*Travail d'élimination.*)—The collection of tubercular matter proceeds then like a true abscess, which having reached the skin, inflames and perforates it, and gives vent to a grumous liquid, consisting of white, cheesy flakes. suspended in a turbid serosity. When all the matter is voided, a fistula remains, which daily furnishes a varying quantity of serous pus.

5. *Reparatory process* (*Travail réparateur.*)—At the end of a period of very variable length, if the patient can stand against the abundant suppurations, a tendency to cure is manifested; the cyst acquires considerable increase, thickens, hypertrophies to the extent of entirely filling up the cavity which it lines, and ends in presenting completely the appearance of fibro-medullary tissue. The termination of this affection is not always so fortunate; it may, however, be stated in a general way, that the disease tends much more towards a cure according as its primitive seat is nearer the skin.

B. Tubercular Infiltration embraces three different states of the bone:

1. *Gray infiltration* (*Infiltration grise.*)—The bony parts which are affected present, in all the points which contain this tuberculous matter, spots of a grayish, opaline, slightly rosy tint, and semitransparent, formed by the deposit in the cells of the bony tissue, of a substance analogous in appearance to encephaloid substance; the circumference, instead of being lost insensibly, is suddenly bounded by a change of colour. By the aid of a lens these spots are seen traversed with blood-vessels of very great delicacy, and sometimes by a very well-marked circle of injection. The density of the bony tissue is neither increased nor diminished.

2. *Purulent infiltration* (*Infiltration purulente.*)—The infiltrated matter assumes, after a longer or shorter time, a pale yellow tint, and becomes completely opaque; it is at first pretty firm, but is not delayed in gradually softening; soon is it entirely fluid and puriform; these collections are always very precisely bounded, as are the spots already mentioned. When the infiltration has reached this period the blood-vessels disappear; the bony tissue undergoes an interstitial hypertrophy, without the bulk of the bone being increased; the little cells are narrowed, and almost completely obliterated, and the cellular tissue of the bone is then as it were like ivory.

3. *Sequestration of the affected part* (*Sequestration de la partie affectée.*)—When the bone has undergone the modifications just mentioned, it exhibits all the characters of a true sequester; there is neither vessel nor any indication of remaining life; besides, a circle of elimination is formed around the infiltrated portions, and the sequestration runs through the whole series of phenomena characterizing *necrosis*; abscesses, fistulas, abundant suppuration, and so on, are the inevitable result. In some instances *necrosis* evidently exists, but its separation is long delayed. It sometimes happens that the necrosed part is detached by little fragments, and in the cyst which forms around the abscess a quantity more or less considerable of bone, like sand, is observed. On the other hand, this purulent infiltration is often propagated to neighbouring parts, and attacks a large extent of bony tissue; these cysts are rarely so limited as in encysted tubercle, and it is not very uncommon to see a consecutive and accidental *caries* developed not in the part primarily infiltrated, but in the bony tissue which surrounds it.

Purulent tubercular infiltration has been often confounded with *caries*; but it is easy to perceive that these two affections differ essentially from each other; in fact, *caries* always proceeds from the periphery to the centre, and infiltration on the contrary from the centre to the periphery. In infiltration, there is an interstitial hypertrophy augmentation of density, absence of vascularity; in *caries*, there is a rarefaction softening and increased vascularity of the bony tissue. Finally, the interstitial hyper trophy is sufficient to distinguish this affection, and that of *necrosis*, and of inflammation with suppuration of the medullary membrane of the bone.

As to the *treatment* little remains to be said. The tuberculous affection is beyond all the resources of art; when it affects an important organ, the patient is generally devoted to death; when it affects the bony tissue, it is rare that it has not been developed in the lungs or in some other organ. However, when it only affects the bones, it may be hoped, that nature will effect the cure; especially if her efforts be seconded by a wholesome diet, a residence exposed to the sun; in a word, by attention to the treatment of scrofula. This happy result is much more frequent at the period of puberty than at any other time of life." (p. 491–93.)

VIII.—OF FUNGUS OF THE DURA MATER, AND OF THE SKULL-BONES.

(*Fungus Duræ Matris*, Lat.; *Schwammige Auswuchs auf der harten Hirnhaut*, Germ.; *Fongus de la Dure-Mère*, Fr.)

Kauffmann, Dissert. de Tumore capitis fungoso post cariem cranii exorto. Helmst.; in Haller, Disput. Chirurg. Select., vol. i. p. 49.

Louis, Mémoires sur les Tumeurs fongueuses de la Dure-Mère; in Mémoires de l'Acad. de Chirurgie, vol. v. p. 1.

Sandifort, Exercitationes Anatomicæ, cap. iii. Lugd. Batav., 1785.

——, Museum Anatomicum Acad. Lugd. Batav., p. 142. L. B., 1793.

von Siebold, C.; in Arnemann's Magazin für die Wundarzneiwissenschaft, vol. i. part iv. p. 142.

Wenzel, J. and C., Ueber die schwammigen Auswüchse auf der aussere Hirnhaut. Mainz, 1811. fol.; with six copper plates.

von Walther, P., Ueber die schwammigen Auswüchse auf der harten Hirnhaut, nach eigenen Beobachtungen; in his Journal, für Chirurgie und Augenheilkunde, vol. i. p. 55.

Schwarzschild, H., Dissert. de Fungis Capitis. Heidelb., 1825. 4to.; with four lithographed plates.

Seerig, A. G. H., Nonnulla de Fungi Duræ Matris origine et diagnosi. Uratislaviæ, 4to.; with three lithographed plates.

Ebermaier, Ueber den Schwamm der Schadelknochen und die schwammartigen Auswüchse der harten Hirnhaut. Düsseldorf, 1829. 4to.

Chelius, Zur Lehre von den schwammigen Auswüchsen der harten Hirnhaut und der Schadelknochen. Heidelb., 1831. fol.; with eleven plates.

Unger, Beiträge zur Klinik der Chirurgie, vol. i. p. 264.

Kosch, Beitrag zur der Lehre von den Schwammgewächsen am Kopfe; in von Graefe und von Walther's Journal, vol. xxiv. p. 542.

Osius; in Heidelb. Med. Annalen, vol. iv. part iii.

2224. *Fungus of the dura mater* is an unnatural growth, arising from the surface of that membrane, which in its further development, by the destruction of the bone, thrusts up beneath the external coverings and raises them into a tumour.

2225. The symptoms at first occurring in this disease, are extremely uncertain and indefinite, as head-ache, sometimes slight, at other times very severe, often periodical, sometimes spreading over the whole head, and sometimes fixed to one spot; afterwards dizziness, a sensation of concussion and confusion in the head; vomiting, pallid countenance, and wasting; loss of sensation in some one part and the like. Sometimes, however, in the early stage, the disease presents no symptoms. As the *fungus* enlarges upon the surface of the *dura mater*, that membrane is separated to a greater extent from the skull, and partly in consequence of this, and in part by the pressure of the swelling, the bone is destroyed by absorption. Before the tumour bursts through the outer table of the skull, that part of the bone crackles under pressure of the finger.

2226. When the bone is destroyed and the *fungus* has arrived under the coverings of the skull, it presents a regular, circumscribed more or less elastic soft swelling, over which the colour of the skin is unchanged. This swelling in general enlarges but slowly, and presents as characteristic signs; *first*, the sensation of *pulsation*, as observed, though more actively, in aneurysm; *second*, the *edge of the hole in the bone*, through which the tumour protrudes, is distinguishable around the whole circumference of the swelling, more or less rounded or sharp, and having numerous pointed projections; *third*, on the condition of this bony edge depends the greater or less painfulness of the swelling; *fourth*, the possibility of returning the swelling into the cavity of the skull with sudden cessation of its painfulness, under which circumstance, the *fungus* is no longer exposed to the influence of the edge of the hole in the bone. With the external protrusion of the tumour, is often connected danger of very urgent symptoms, as small pulse, vomiting, continual gulpings, cold hands and feet, frequent faintings, and cold sweats over the whole body. These symptoms, together with loss of sensation, palsy, and loss of intellect, may be consequence of keeping back the *fungus* by art, or by change of position to the other side.

2227. The pulsation often diminishes as the swelling increases, and is scarcely perceptible; the edge of the hole in the bone may also be concealed as the outer part of the swelling spreads over it. The skin becoming still more tense, reddens, thins, at last bursts, and a *fungus* protrudes through the opening, which bleeds frequently, and secretes an ichorous fluid mixed with blood. Hectic fever arises in consequence of this loss of the juices, of the restlessness, and of the violence of the pain; and under the colliquative symptoms death ensues, preceded for a longer or shorter time by a sleepy state, frequent faintings, loss of some of the senses or of the powers of the mind.

2228. Examination after death exhibits a swelling of a brownish colour, sometimes more or less grayish white, at some parts often a medullary substance, of which some lobes are enveloped in their cellular tissue, and to a certain extent held together. This substance is penetrated by more or less vessels, in general connected not very firmly with the *dura mater*, and not at all organically with the edge of the hole in the bone, but only retained by the pointed projections and dentations of the edge of the bone. Upon the external surface of the bone, the edge of the hole is sharply defined, but on the inner table it runs off obliquely, so that the inner plate is always further destroyed than the external; a decided proof that the *fungus* has burst through the skull *from within outwards*. This is also shown by preparations, in which the *fungus* not having yet completely destroyed the bone, the external table is undisturbed, and neither the bone nor the *pericranium* in any way diseased. Not unfrequently such swellings appear on several parts of the skull in various degrees of development, just like swellings situated on other bones of the body.

2229. *Fungus* of the *dura mater* is distinguished by the above described symptoms from other diseases of the skull, from encysted melicerous, and atheromatous swellings, and from *hernia cerebri*, and specially as the latter either exists from birth or is produced after some injury of the skull, accompanied with loss of substance. SCHNIEBER (*a*) has indeed mentioned a congenital *fungus* of the *dura mater;* I have, however, with SEERIG (*b*), doubts of the correctness of the *diagnosis* in this case.

2230. The views already stated in reference to the origin and course of *fungus* of the *dura mater*, which have been specially laid down by LOUIS, WENZEL, and others, and which I have found confirmed by my own observation on the living and by examination of the dead, are opposed to those advanced by SANDIFORT, SIEBOLD, and WALTHER. According to the latter writers, *fungus* of the *dura mater* is a simultaneous degeneration of the *dura mater*, of the skull-bones, and of the external *periosteum*, but especially of the blood vessels which pass from the latter to the *diploë*, and from it to the *dura mater;* a luxuriant vegetation of the net-like tissue between the two tables of the skull bones, with which the bone-earth is sucked up and a *carnation of the bone* at the same time arises. This opinion, which had already been advanced by LOUIS in some cases, WENZEL (*c*) admits only so far as he supposes that the original seat of the disease is restricted merely to that part of the bone on which the diseased cause so operates, that the natural functions are in some way disturbed and interrupted; and this may be sometimes the outer, sometimes the inner table of the bone, sometimes both together, and sometimes the *fungous* tissue which lies between them.

2231. Directly opposed to the symptoms on which WENZEL founded his *diagnosis* of this disease, are those which WALTHER has advanced, supported by his own views and careful observation. He did not, indeed, notice any motion of the swelling; the patient experienced only a certain roaring and rushing, best comparable with that which sometimes is perceived in the external ear-passages in violent beating of the carotid artery and its branches. A certain obscure movement was felt in the swelling, but however only when the hand, or still better the tips of the fingers, are applied and pressed strongly upon it for a long while; the movements are in this way, after some time, distinctly felt. In one case an alternate rising and sinking of the tumour was observed, similar to that concussion which the beating of the arteries produces in all parts of the body. Its degree corresponds with the number and extension of the arteries in the swelling; the movements are similar to the beats of the pulse, and correspond with them. WALTHER could not feel any bony edge around the circumference of the swelling, and considered this proved, because the hole in the bone was firmly, and throughout its whole extent filled with the swelling. When the *fungus* attains considerable size, no symptoms of compression of the brain are observed; but in very rapid growth they possibly may be. The external part of the tumour can be returned through the hole in the bone never, or but very rarely, and only whilst it is still small and recent, in which case symptoms of compression of the brain must at once ensue. WALTHER found, in general, that the swelling was completely free from pain, and that it was in no way sensible of touching, or of moderate pressure. The connexion of the *fungus* with the skull-bones was always firm. The *periosteum* began to thicken at a considerable distance from the swelling; and the thickening increased as it approached the tumour, and there the *periosteum* seemed reddened; it was firmly connected with the *fungus*.

(*a*) VON GRAEFE und VON WALTHER'S Journal, vol. ii. p. 641.

(*b*) Above cited, p. 24.

(*c*) Above cited, p. 95.

2232. Both these opinions are true, and founded upon careful observation; but it is improper to attempt setting aside the one by the other, as both are obtained from different states of the disease. The opinion of LOUIS and WENZEL is applicable only to the true *fungus* of the *dura mater;* that which SIEBOLD, SANDIFORT, WALTHER and others have noticed, is not entitled to the name of *fungus* of the *dura mater*, but is to be distinguished as a *fungus* of the skull, (*Fungus cranii*,) as the degeneration in it begins either from the *diploë*, or from the *dura mater* and *pericranium* at the same time, and the bone is converted into a fungous substance of greater or less firmness. This distinction between *fungus duræ matris* and *fungus cranii* equally applies to similar degenerations in other bones, *where fungous growths are developed between the periosteum and bone, and the bone is destroyed merely by these increasing masses; whilst other fungous growths proceed from the bone itself and from the medullary substance, and the bone is converted into a fungous, sarcomatous, steatomatous, or other kind of substance.*

Those growths which are formed on the external surface of the *dura mater* in consequence of ulceration of the skull-bones, must be distinguished from true *fungus* of the *dura mater.*

2233. If the several origins of *fungus* be reviewed, five different forms, must, according to the observations of myself and others, be distinguished.

First. The *dura mater alone* is capable of fungous degeneration, which appears either on its internal or external surface, or on both at once. The fungous parts of the external surface of the *dura mater* are connected firmly with the more or less completely destroyed internal surface of the skull, so that the organically connected excrescence of the *dura mater* is converted gradually into the same fungous, steatomatous, or fibrous substance. When this degeneration gradually affects the skull-bones throughout their whole thickness, and by its external protrusion forms a swelling, it becomes firmly connected with the bone, and imperceptibly involves it, so that perhaps only at certain parts can its bounds be perceived through the firm edge of bone. Such tumour admits of no return, nor is any pulsation felt; at least the pulsations of the brain can alone be communicated to it when a large extent of the skull is included; they can, however, only be very slight, and distinguished always by their regularity, from the pulsation of single vessels, with their numerous ramifications in the swelling.

In the other kind of isolated fungous degeneration of the *dura mater*, the degeneration is restricted *entirely to it*, and ordinarily *to its external surface alone.* The *fungus* arising from the external surface of the *dura mater* is especially characterized by the enlargement of its substance, without destroying the surrounding parts otherwise than by pressure, on which account the *fungus* is only organically connected with the seat of its original development, and never with the bones of the skull, which it destroys. The destruction of the bones, already noticed as occurring in the progressive increase of the *fungus*, always corresponds to the extent of the tumour, extends from within outwards, and at last bursts through the external table of the skull, so that the swelling is perceived externally beneath the coverings of the skull. Hence on examination, according to the various degrees of development of the *fungus*, more or less deep hollows are noticed on the inner table of the skull; and when the skull is completely burst through, the destruction of its inner table is always to a fa greater extent than the opening in the outer table, its edge sharply defined, and without exhibiting any other change. When the swelling appears externally, the edge of the bone throughout its whole circumference is distinctly perceptible; the swelling pulsates actively and synchronously with the beat of the arteries, and so long as it has not acquired considerable size, may be wholly or in part returned into the cavity of the skull, and then more or less severe symptoms of compression of the brain occur. The *pericranium* surrounding this swelling is either sac-like or more or less united to it, which merely results from the continued pressure and inflammatory irritation, as noticed in all tumours in relation to their coverings and envelopes.

2234. *Second.* The *dura mater* and *pericranium* may degenerate *at the same time*, so that if a fungous mass is formed between the two and the corresponding surfaces of the skull-bones, with which it is organically connected, the destruction of the bone results only from its conversion into this substance, and proceeds from its two surfaces towards the middle, so that the *diploë* is at last destroyed. So long as the fungous mass has not completely destroyed the bone, it forms a more or less large and elevated swelling, which is either imperceptibly lost in the bone, or an edge of bone can be felt here and there on its circumference. The swelling is more or less firm, shows no trace of communicated pulsation from the brain, so long as the skull still remains not completely destroyed; and only when there is great vascular development in it, can the isolated pulsation of the several vessels be distinguished by examination with the fingers, but which, in reference to its strength, cannot be compared with that in true *fungus* of the *dura mater.*

2235. *Third.* The fungous mass may be developed *between the skull and the pericranium*, as *fungus pericranii.* Here, at least according to the observations hitherto made, the substance is always firmly connected with the bone; indeed, for the most part, is formed by the diseased change of the bone. The substance may form considerable growths, and may also spread more towards the surface. When the fungous mass has changed the skull through its entire thickness, it is always so closely and firmly connected at its edge with the bone, that those symptoms which exist in true *fungus* of the *dura mater* cannot be present, and the swelling is specially under the same circumstances, as a swelling of like kind on other bones.

2236. *Fourth.* The degeneration *begins in the net-like tissue of the diploë*, and extends gradually inwards and outwards, or more towards the one than the other. The swelling is here equally firmly and organically connected with the bone; when it has completely destroyed the bone at the seat of the degeneration, it presents a similar connexion with the *dura mater* and *pericranium;* and there is neither pulsation nor possibility of replacement; at the very most the edge of the bone can only be perceived at one or other place.

2237. *Fifth.* There may be, finally, several of the above-mentioned diseased, and in regard to their origin, different changes present at the same time, according to which the symptoms variously present themselves (*a*.)

2238. The *causes* of fungous growths of the *dura mater* and skull-bones are either internal or external. To the former belong *syphilis*,

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(*a*) CHELIUS, above cited, p. 69.

rheumatic affections, scrofula, and other diseases which are connected with an altered condition of the juices. To the external causes belong blows upon the head, bruises, concussion of the skull without external injury or fracture of the bone. The distinction of the causes is frequently attended with great difficulty, as the external injury has often so long preceded the origin of the complaint, that its causal relation to it is doubtful. When the disease arises without external violence, the presence of internal disease is not always clear; but the progress of the complaint, and the existence of similar degeneration in other parts, points to a peculiar *diathesis*, often characterized by no other symptoms than the tumour: and in this respect, indeed, it must be distinguished as the *diathesis fungosa.* I do not imagine, that without this internal condition, external causes can of themselves produce such fungous degenerations. As the result of these causes, an inflammatory condition is always to be considered as the peculiar commencement of the disease, by which plastic exudation, irregular vascular development, and the like, are produced. According as these processes occur, at the same time, on the surface of the *dura mater*, in the bone itself, under the *pericranium* and upon the *dura mater*, the proper *fungus duræ matris* and *fungus cranii* are produced.

2239. *Fungus* of the *dura mater*, and of the skull-bones, is a very important disease, which left to itself causes death, and the *cure* of which, or even its mitigation, is usually impossible. In those cases where the complaint is, from the symptoms mentioned, (*par.* 2225,) supposed to have arisen from external injury, its development may perhaps be arrested by the early and continual use of cold applications, by taking away blood, active purging, low diet, and the like. But if the swelling have already become apparent externally, there is no remedy but its removal, by the ligature or the knife after previously laying bare, and enlarging the hole in the bone; cutting into the tumour, the constant application of pressure, and the use of escharotics, can only promote an unfavourable result.

Walther supposes that the operation is contraindicated in *fungus* of the *dura mater*, and that only the peculiar kind and special condition of the case, may here and there form an exception. He is confirmed in this opinion by the view he takes of the origin of the *fungus*, and by an operation he performed, in which, after the first cut, so severe bleeding ensued, that he was obliged to abstain from finishing the operation. In reference to *fungus cranii*, I must, from my own observation, assent to this opinion. But the operation for true *fungus* of the *dura mater* must be considered permissible, if the disease have not advanced too far; if there be only a swelling, and no degeneration of the other parts. The *prognosis*, however, in this operation, is always extremely doubtful; independent of its danger, it has scarcely ever a permanent result, as, at least according to my experience, the *fungus* of the *dura mater* is always characterized as *medullary fungus*, (*Fungus medullaris*,) which, on account of the general *diathesis*, is always incurable.

2240. In performing this operation, the general coverings are to be divided upon the swelling with a crucial cut, extending beyond it on either side to the extent of an inch; the flaps are then separated and turned back. The *galea aponeurotica* and *periosteum* are found unconnected with the tumour, and to be divided like the skin, for the purpose of laying bare the *fungus*; or this may be done by two cuts on the base of the swelling. The edge of the hole in the bone having been exposed, it must be endeavoured by repeated applications of the crown of the trephine, and by removing the intermediate pieces with **Hey**'s saw, to obtain a space large enough for the examination of the base of the swelling. If its connexion with the *dura mater* be then found not very firm, it may be separated with the finger, or with the knife-handle; or if its connexion be firmer, it may be carefully cut away with the knife; or that part of the *dura mater* to which it is attached may be cut off; or a ligature may be applied with a loop-tier, which, however, on account of the readiness with which serious symptoms are set up, should be tied with very great caution (*a*). The after-treatment is to be guided according to the rules laid down for the operation of trepanning.

Only under the above-mentioned restrictions, is the removal of the *fungus* permissible; in every other case the operation merely hastens death. Thus, in Berard's (*b*) case, who by means of sixteen applications of the trephine, made an opening in the skull five inches long and four and a half wide, which laid bare the *dura mater* with the longitudinal *sinus* and the upper edge of the *falx*, after the removal of the outer part of the swelling, pulsation was observed in the rest of it; fainting and convulsions immediately ensued, and the patient died in twenty-four hours. The swelling arose from the outer surface of the *dura mater*, and after destroying the bone, had protruded through an oblong aperture, whilst its base spread beneath the skull. Its structure resembled that of brain. The inner surface of the *dura mater* was healthy.

Orioli (*c*) removed a *fungus* of the *dura mater* successfully. A little swelling projected beneath the right ear, accompanied with loss of sight, and had gradually reached the size of a small nut. The whole swelling pulsated, but was compressible, and the pulsation then ceased; it also for the most part ceased when the temporal artery of that side was compressed. Neither bony edge nor crepitation was felt beneath, or on the side of the swelling. The disease was thought to be a temporal aneurysm. In three weeks the tumour had increased about two-thirds; head-ache and singing in the ears came on, and an operation was thought necessary. The artery having been compressed, a T shaped cut was made through the coverings, and the temporal muscle cut through; but the tumour was deeper, and the operator ascertained it was not aneurysmal, and that the bone was probably affected. After dividing the *pericranium*, a hard, irregular edge was felt around the swelling. The *pericranium* having been separated, the bone was found carious to the extent of a half-dollar; the tumour was seated with a broad base upon the *dura mater*, and difficult as it was, Orioli removed as much as possible of the length and breadth of the fibro-fleshy mass. Two arteries were plugged, and the patient dressed. On the ninth day the wound was sloughy; the slough separated gradually, and some pieces of brain were also thrown off. The bottom of the wound now pulsated synchronously with the arteries and with the movements of the brain. As the wound cleansed, there appeared however on one side a swelling, similar to the former, which was successfully compressed with lint. In fifty days the cure was complete. A firm scar covered the part where the hole in the bone was, and the movements of the brain were felt. The singing in the ears subsided; sleep returned, but sight was completely lost.

Besides the above-mentioned writers, the following may also be consulted :—

von Siebold, B., Entstehung und Ausgang einer beträchtlichen und mit dem Winddorne am Schädel verbundenen scrophulösen Speckgeschwulst auf dem Scheitel; in Chiron., vol. ii. p. 667, pl. 8, 9.

Palletta, De Tuberculis ossivoris. De Tuberculis Capitis, p. 93; in Exercitationes Pathologicæ. Mediol., 1820.

Eck, Kleiner Beitrag zu der Lehre von den schwammigen Auswüchsen an dem Schädel; in von Graefe und von Walther's Journal, vol. v. p. 105.

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Blasius, De Fungi Duræ Matris accuratiori distinctione. Hal., 1829.

Hübner, Dissert. de Fungo Duræ Matris. Heidelb., 1832.

Seifert, Dissert. de Fungo Capitis in universum, et de Fungo Duræ Matris in specie. 1833.

(*a*) Ficker, Ueber die schwammigen Auswüchse auf der harten Hirnhaut; in von Graefe und von Walther's Journal, vol. ii. p. 218.

(*b*) Gazette Médicale, vol. i. p. 735. 1833.

(*c*) Bulletino delle Scienza Mediche. May, 1834.

IX.—OF FATTY OR ADIPOSE TUMOURS.

(*Lipoma, Tumor adiposus*, Lat.; *Fettgeschwulst*, Germ.; *Lipôme*, Fr.)

SCHREGER, Ueber Lipome und Exstirpation derselben; in his Chirurgische Versuche, vol. i. p. 297.

VON WALTHER, P., Ueber die angebornen Fetthautgeschwülste und andere Bildungsfehler. Landshut, 1814; with two plates.

VON KLEIN, Ueber die Ausrotung verschiedener Geschwülste; in VON GRAEFE und VON WALTHER's Journal für Chirurgie und Augenheilkunde, vol. i. p. 109.

BRODIE, Sir B. C., Lectures illustrative of various subjects in Pathology and Surgery. London, 1846. 8vo.

2241. The *fatty*, or *adipose tumour*, depends on an unnatural collection of fat, heaped up either in the *panniculus adiposus*, or between the plates of the cellular tissue beneath the skin, according to SCHREGER, in the mucous bags of the first and second orders.

2242. These tumours are developed slowly, and without any uneasiness; they give to the touch a peculiar softness, which cannot be better compared than to that of a bag filled with cotton; their surface is irregular, and distinct conglomerations are felt upon them, which are not hard, and are easily compressed. When they have reached a certain size, they in general grow quickly, and may acquire a very considerable bulk. As long as the swelling is small, the skin upon it remains unchanged, but when it has become very large, the circulation is impeded by the dragging and tension of the skin, the cutaneous veins become expanded, dropsical swelling takes place, the skin inflames, especially if the tumour be seated on any part where it can be affected by chafing or external injury, and the inflammation may run on to ulceration. The form of a fatty tumour is in general oblong, and has a neck.

[That fatty tumours have generally a neck is not, according to my observation, correct. They usually have a broad base, and raise up the skin like hillocks. Very rarely they have a neck; and in St. Thomas's Museum is the cast of a very remarkable one, which weighed from fifty to sixty pounds, was attached by a narrow pedicle to the throat, and hung down to the man's knees. JOHN HUNTER saw him, when the tumour was only of small size, and did not think it could be safely removed. The man died some years after in Shoreditch Workhouse.—J. F. S.]

2243. According to the two-fold origin of fatty tumours already mentioned, (*par.* 2241,) two different kinds may be distinguished which are characterized by marked symptoms.

Those fatty tumours which belong merely to the *panniculus adiposus*, and are only knobby masses of fat at certain parts, have no well-defined edges, but subside into the surrounding parts, (*Lipoma diffusum*,) are very soft and easily compressible, and so connected with the skin that the latter can be moved or lifted in folds upon the swelling. The fat lies under the generally thinned *corium;* no general sac exists, and some parts only are enclosed in thin and simple walls. The fat is similar to that of other parts of the body, only a little firmer.

[This is the form of fatty tumour which BRODIE mentions as "not well defined; in fact there is no distinct boundary to it, and you cannot say where the natural adipose structure ends and the morbid growth begins." He relates the case of a person with an affection of this kind, "an enormous double chin hanging nearly down to the *sternum*, and an immense swelling also on the back of his neck formed by two large masses, one behind each ear, as large as an orange, and connected by a smaller mass between them. * * * Such deposits may probably take place in any part of the body, but I have seen them," says BRODIE, "more frequently in the neck than elsewhere." (p. 275–77.) Not unfrequently very stout persons, more especially women who have borne children, have large collections of fat between the skin and abdominal muscles below the navel, which hang down in a thick fold, like an apron, to the *pubes*. It has been dignified with the name of pendulous belly. The female breast also sometimes becomes enormously loaded with fat, even in very young women. BRODIE mentions a case of this kind, which grew so large that it was removed on account of its inconvenient size, which on dissection turned out to be "a fatty tumour, and a chronic mammary tumour, blended with each other," and disposed layer on layer. (p. 281.) But whether on the neck, belly, or elsewhere, it seems to be merely a superabundant deposit of fat, a hypertrophy, which can hardly be considered a disease, though it certainly is a great inconvenience.—J. F. S.]

2244. The other fatty tumours which arise between the two plates of the cellular expansion beneath the skin, from an increased and altered vegetation of the mucous bags of the first and second order, are situated deeper, are covered with the *panniculus adiposus*, have a defined boundary, greater mobility, more elastic hardness, and are enveloped in a proper cellular cyst, which is commonly so firmly connected with the fat that they can scarcely be distinguished. In general this cyst is very thin, often still thinner as the swelling becomes larger; only in rare cases is it firm, tendinous, and in part cartilaginous. This tumour consists of spherical masses of fat, which differ from the natural fat, nearly resembling a slice through the brain, or through a lymphatic gland, without cavities and partitions; sometimes they appear as if composed of circularly twisted or radiately disposed plates (*a*).

With the opinion of this twofold form of *lipoma*, which may be sufficiently distinguished by external examination, microscopic observations also agree. The substratum of *lipoma* is the fatty tissue intermingled with blood-vessels and cellular tissue in indefinite proportions. The *lipoma* which belongs to the *panniculus adiposus*, consists of cellular tissue, with a few vessels, and sometimes starlike groups of needle-shaped crystals, (margarin, or margaric acid,) are found in the fat-cells. In the other form more bundles of cellular fibres are observed, which spread between the groups of fat-cells.

J. MÜLLER (*b*) divides fatty tumours into, *first*, *Lipoma*, in which the fat is found in the common fatty cellular tissue, and is merely isolated by the walls of numerous cells thrust together; *second*, *Fatty cysts*, in which the fat is not contained in little cells, but partly fluid, partly in form of fat-corpuscles, is enclosed in one large and generally thick membranous cyst. In the former case, the production of the fat goes on in the ordinary way, as previously in the healthy body; in the latter there is, as it were, one predominant fat-cell, and its wall thickens into a firm cyst. The *lipoma*, generally lobed, is not distinguished from the ordinary form of fatty cellular tissue, its cells are roundish and oval, the single difference consists in the firmness of this conglomeration of fat-cells, which usually possesses a more or less strong cyst of thickened cellular tissue, whilst the single lobes are enclosed in thinner layers of cellular tissue. MÜLLER distinguishes, *a. Lipoma simplex*; *b. Lipoma mixtum*, where the interstitial cellular tissue considerably thickened and membranous, forms strong plates, which run through the *lipoma*, rendering it firmer than the common *lipoma*; *c. Lipoma arborescens*, branching productions, which consist entirely of fatty cellular tissue. The *fat cyst* (*Cystis adiposus*) is, at least in the skin, similar to the *Tumor sebaceus*. The fatty tumour in layers (*Cholesteatoma*) consists of pearly shining leaves or layers of polyhedric cells, without any lobular formation. The tumour, of the consistence of suet, is surrounded by a membrane generally very thin, rarely thicker than a common cyst. The *cholesteatoma* also occurs as a deposit upon ulcers. It has not any blood-vessels (*c*).

[Fatty tumours of this kind vary considerably in size between half a pound and half a dozen pounds; but some examples have occurred of enormous bulk. ASTLEY COOPER removed a fatty swelling of the breast which weighed fourteen pounds and ten ounces; it is in the Museum at St. Thomas's. COPLAND removed one from a female's thigh, weighing twenty-two pounds. The largest which has been met with in this country, is that removed by ASTLEY COOPER (*d*) from a Danish sailor in Guy's Hospital, which covered all the front of the belly below the navel, and formed an immense swelling, which after removal weighed thirty-seven pounds and ten ounces. It was a remarkable

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(*a*) SCHREGER, De Bursis Mucosis subcutaneis, p. 12. Erlang., 1825.

(*b*) Above cited, p. 49.

(*c*) Compare also VOGEL, above cited.—HEYFELDER, De Lipomate. Commentatio loco in Facultate Medicorum Univers. lit. Erlang. rite obtinendo.

(*d*) Med.-Chir. Trans., vol. xi. p. 440. 1824.

circumstance in this man's case, that notwithstanding this bulky protuberance, he had done his duty on shipboard till within a few days of his admission. The tumour is in the Museum at St. Thomas's. **Lawrence** (*a*) mentions that a French Surgeon removed a fatty tumour from the left *hypochondrion*, which weighed forty-six pounds, and was one of eight in the same person, the others of which, however, were not so large. **Portalupi** (*b*), of Venice, removed a large pyriform fatty swelling which hung from the left side of the neck and chest, measured in length twenty inches and a half, twenty-seven inches around its upper narrower part, and thirty inches below, and weighed fifty-two pounds; no blood-vessel of size was divided, nor was any ligature required; and in the course of seven weeks, the patient was cured.

Although generally seated almost immediately beneath the skin, these fatty tumours are sometimes situated beneath the muscles, and then give rise to much difficulty in *diagnosis*, of which **Brodie** mentions a good example, where the tumour was beneath the *trapezius;* in another case the fatty mass was behind the gland of the breast, which it had lifted up, and caused great doubt as to the character of the disease, till explained by the operation. He also mentions a case in which a large tumour in the *scrotum* lay behind the testicle, but quite distinct from it, and gave the impression of being an omental *hernia;* it was, however, determined to operate on it, and it was then discovered to be a fatty tumour connected with the spermatic cord within the abdominal ring, which as it had grown, descended into the *scrotum.* (p. 271.)

Among the rarest situations of fatty tumours, the tongue may be mentioned: in the Museum of the College of Surgeons there is a specimen of a small lobulated fatty swelling which had been removed from that organ.]

2245. The *causes* of fatty tumours are unknown. Rarely can they be ascribed to pressure, blows, or any other violence. They are seen at all ages and in both sexes, though most frequently in adults; they seem also to be more frequent in females, though without any relation to menstruation. They generally occur on the shoulders, upon the back and on the neck; but are, however, observed on other parts, and even on such as have naturally very little disposition to fat. Oftentimes several fatty tumours occur, even in considerable number in the same individual. Not unfrequently is a fatty tumour congenital, and then often acquires considerable size; in this case too, sometimes the general coverings are more or less altered, loosened up, dusky coloured, beset with large quantities of and longer hair than natural. Such have been named by **Walther** *fatty mother-marks* (*Nævus maternus lipomatodes*, Lat.; *Fettmuttermahl*, Germ.) The disease also usually spreads after birth to a considerable extent.

2246. Fatty tumours are always to be considered important diseases, as they enlarge very quickly, spread, and run into ill-conditioned ulcers (1). Small swellings may indeed in many instances be dispersed by the application of gum ammoniac dissolved in vinegar of squills, by rubbing in ox gall, nut oil, and liquor of acetate of ammonia (2). Their removal with the knife is, however, generally the only certain mode of treatment.

This operation is easy and without any danger in those fatty tumours which have a broad base; but it may be difficult and dangerous if the swelling be of great extent, lie in the neighbourhood of important parts, or if it have deeply-stretching roots. Under these circumstances, it is not often possible to remove all the degeneration, even with the greatest care, so that either the fatty growth begins anew, or a long-continued ill conditioned suppuration ensues, and even fistulas, which remain throughout life. Not unfrequently the general formative action appears to be increased by the operation, as often not only in the neighbourhood of the part operated on, but also in distant parts, where previously no *lipoma* had existed, it sprouts forth. It must also not be forgotten, in reference to

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(*a*) Lectures on Surgery; in Lancet. 1829-30; vol. i. p. 869.

(*b*) **Omodei**, Annali Universali, vol. xxviii p. 343. 1823.

the performance of the operation, that many *lipomata* are so considerable, and so largely penetrated with branching vessels, that the operation is attended with considerable bleeding (3).

[(1) As regards ulceration, Brodie observes:—"The skin over a fatty tumour very rarely inflames and ulcerates. You might *à priori* expect that the pressure of the tumour would often produce this effect, but it is not so. I have, however, known inflammation to take place in the substance of the tumour, and an abscess to form in its centre." And he mentions a case in which this happened in a large tumour on the back; "the abscess never healed, but continued to discharge profusely matter with an oily fluid floating in it," till the swelling was removed. (p. 273.)

He also refers to Astley Cooper's opinion, that "a fatty tumour will sometimes take on the action of a malignant disease, and become a malignant tumour," and is inclined to agree with it in consequence of a case which he operated on, "composed of what seemed to be fatty substance, somewhat more condensed than usual; but that here and there, dispersed throughout the mass, there was another kind of morbid growth, apparently belonging to the class of medullary or fungoid disease. It is reasonable to suppose that if this tumour had been allowed to remain, it would have ulcerated, and run the usual course of a malignant disease." (p. 282.)

(2) In the case of diffuse fatty tumours of the neck, already referred to, (p. 690,) Brodie "gave half a drachm of the *liquor potassæ* three times a day, and gradually increased the dose to a drachm, dissolved in small beer;" the result of which, after some time, was, that considerable absorption of the swelling occurred, though "there were still some remains of the tumour, but nothing that was very remarkable. I have seen" he observes, "some other cases in which the exhibition of very large doses of the *liquor potassæ* appeared to be of great service." (p. 276.) For the more common circumscribed fatty swellings, there is not, as far as I have had opportunity of seeing, any remedy to produce their absorption, whether they be small or large, and therefore to be got rid of, they must be removed by the knife. It is not needful, however, to meddle with them if their size do not inconvenience the patient, and so long as they remain stationary, which they often will for years. But if they at any time begin to increase, they should be at once removed, as when this action begins, it generally continues more or less quickly.

(3) Easy as the removal of fatty tumours undoubtedly is, it not unfrequently happens that there is a good deal of boggling from inattention to the simple circumstance of cutting through the cellular cyst surrounding them, to the extent of the external wound, and fairly into the fatty tumour itself. If the cyst be thus opened, the operation may generally be completed by running the finger or the handle of the knife between it and the tumour, which usually turns out like a kernel from its shell, being only here and there held by little processes of cellular tissue, or little bundles of vessels, which are best torn through, or if too tough and large to admit this, must be cut with the knife. If, however, the cyst be not opened, the tumour will not turn out, and must be fairly dissected out with the knife, which is very tedious and inconvenient, as almost every little vessel divided bleeds freely and requires tying, the former of which does not happen, and the latter is therefore unnecessary, if the tumour be torn from its cyst, which is an additional reason why this method should be preferred. It occasionally happens indeed, that after the removal of the tumour in this manner, the cavity suppurates and heals by granulation; but this is matter of little consequence, and only slightly retards the cure.—J. F. S.]

2247. The removal of *lipoma* is managed according to the same rules laid down in regard to encysted tumours. The wound may be brought together, if the base of the *lipoma* be not large, and the whole has been completely removed, and united by quick union. But in large *lipomata*, which cannot be cleanly turned out, when the wound has been brought together, only an imperfect union of the skin with the corresponding surface of the wound is produced; as at every part where little bits of fat remain, union does not take place, a fatty purulent lymph flows out; and, if its escape be prevented, inflammation of the skin, bursting again of the united parts, continued ill-conditioned suppuration, and fistulas, remaining even throughout life, are produced (1). After the removal of diffused *lipoma*, therefore, the edges of the wound are to be kept apart by proper dressing, till the discharge has lost its oily character, and healthy suppuration is set up; and then the cure is to be promoted by bringing together the edges of the wound. When the swelling is penetrated by a great many vessels, or its roots cannot be removed by the knife without great danger, it may be necessary to apply a ligature around its base, which must be isolated as much as possible, and the swelling cut off beyond it. Under these circumstances, the destruction of the remaining substance, by the use of escharotics, is exceedingly difficult, and even impossible (*a*).

The employment of a seton for the removal of *lipoma*, is only fitting when the extirpation is impossible. This method, however, is always extremely uncertain, as the swelling either does not go away, or soon recurs.

[(1) I have never seen the inconveniences to which Chelius here alludes, which may certainly be prevented by attention in properly dressing the wound, and the application of compresses, on any part where there is a disposition to bagging of the pus. As a general rule, it is also advisable to follow the roots of the tumour, should they spread out as they occasionally do; but sometimes this cannot be managed without doing mischief, by disturbing important parts; it is then best to tear through these roots, as far in as possible, and usually in the course of the cure they suppurate and disappear.—J. F. S.]

X. OF ENCYSTED TUMOURS.

(*Tumores cystici, sacculi, tunicati, Cystides, Lupiæ, &c.*, Lat.; *Balggeschwülste, Sackgeschwülste*, Germ.; *Tumeurs enkystées*, Fr.)

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Bichât, Traité de Membranes, p. 181. New Edition by Hasson. Paris, 1816.

Jaeger, M., Ueber Balggeschwülste; from the Encyclopædische Wörterbuch der Medic. Wissenchaft, vol. iv. p. 634. Berlin, 1830.

2248. *Encysted Tumours* are swellings developed in the cellular tissue of the skin, or in the interstitial cellular tissue of other parts, and characterized by a proper membrane being formed, in the cavity of which there is a secretion of a peculiar substance. That this membrane does not result from expansion and thickening of the cellular tissue, but must be considered as a new formation, which, in reference to its nature and its vital peculiarities, agrees with serous membranes, has been clearly shown by Bichat. The circumstance, that a cyst is formed around foreign substances accidently introduced into the body, does not controvert this opinion: as this cyst, manifestly originating from pressure on the cellular tissue, is not a peculiar secreting organ.

Meckel (*b*) may be consulted in opposition to the opinion advanced by Adams (*c*), that all encysted tumours are to be considered as animals of the lowest kind, to wit, as hydatids.

[(1) With reference to the formation of cysts around foreign substances, John Hunter (*d*) speaks of it as an example "of the deeper seated parts not so readily taking

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(*a*) Schreger, above cited.

(*b*) Handbuch der Pathologischen Anatomie, vol. ii. part ii. p. 132.

(*c*) Observations on the Cancerous Breast. London, 1801. 8vo.

(*d*) On the Blood, Inflammation, &c.

on the suppurative inflammation as those which are superficial; * * * for we find that extraneous bodies are in general capable of producing inflammation; but if these extraneous bodies are deeply seated, they may remain for years, without doing more than producing the adhesive inflammation, by which means they are inclosed in a cyst, and only give some uneasiness."—(pp. 238, 39.) An example of this kind I recollect having seen several years since. A medical student in Paris had, for want of better employment, mixed himself up with some popular disturbance, to quell which the military were called in, and he received a wound in the buttock, which soon united, but left some uneasiness and a defined swelling. About three years after, I saw Dupuytren, at the Hôtel Dieu, cut into this tumour, from which a quantity of glairy fluid escaped; and the finger being introduced into it, about an inch and a half of a sabre-point was felt and removed. But the lodgement of an extraneous body without producing suppuration is not confined to deep-seated parts; for Hunter, very shortly after observing in regard to pins and needles, which, when having been introduced into the body, are well known, in general, not to produce suppuration, but either lie quietly in one place, or move over the body to an almost incredible distance from the point at which they had entered: that "they owe their want of power in producing suppuration, not entirely to situation, but in some degree to the nature of the substance, metals, perhaps, not having the power of irritation beyond the adhesive; for when the adhesive has taken place, the part appears to be satisfied;" he continues, "this appears also to be the case with the introduction of glass, even in the superficial parts; a piece of glass shall enter the skin, just deep enough to bury itself, inflammation shall come on, the wound in the skin, if brought together, shall heal by the first intention, and the inflammation shall not exceed the adhesive, but rather degenerate into the disposition for forming a sack, by which means a sack is formed round the glass, and no disturbance is given to the irritability of the parts."—(pp. 239, 240.) Besides the example which Hunter mentions, in proof of this latter statement, I may refer to the case of the tobacco-pipe in a man's cheek, which I have already mentioned (p. 380); and there is in the Museum of the Royal College of Surgeons a portion of a glass mirror, which by a fall was driven into a girl's breast, and there remained for many weeks, without exciting suppuration. These examples prove, and even from his own showing, that Hunter's first statement, of "deep-seated parts not so readily taking on the suppurative inflammation as those which are superficial," is not borne out. Nor has it yet been explained, how it is that foreign bodies do become encysted, rather than set up suppurative inflammation, by which, as under common circumstances, they are expelled from the body.—J. F. S.]

2249. Encysted tumours are distinguished according to the consistence and nature of the substance contained in their cavity, as, first, Serous Cysts (*Cystes serosa*, *Hygroma*, Lat.; *seröse Balggeschwülste*, Germ.; *Loupes séreuses ou aqueuses*, Fr.) (1); second, Melicerous Tumours, (*Meliceris*, Lat.; *Honiggeschwülste*, Germ.; *Loupes méliceriques*, Fr.,) when the contained substance is of the consistence of honey (2); third, Atheromatous Tumours (*Atheroma*, Lat.; *Breigeschwülste*, Germ.; *Loupes atheromateuses*, Fr.,) when it resembles pap (3). To these kinds of encysted tumours Abernethy (*a*) adds a fourth, in which the cavity is filled with nail or horn-like substance, which, when the skin breaks hardens, and projecting, as the cyst continues to secrete, forms a horn-like growth (4).

[(1) Simple serous cysts, on the exterior of the body, are not of frequent occurrence. When existing in the neck they are commonly called "Hydroceles of the Neck," under which name they were first described by Maunoir (*b*), who mentions that the disease had been confounded with bronchocele, on account of its external characters, and had been noticed without knowledge of its real nature by Heister, Plouquet, and Petit. "It consists," he says, "simply of a collection of serous or lymphatic fluid; * * * it is an affection *sui generis*, tolerably frequent, and not as has been supposed a rare and unusual form of bronchocele." (p. 95.) Cases have since been described by Dr. O'Beirne (*c*) and by Bransby Cooper (*d*). They com-

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(*a*) Above cited, p. 113.

(*b*) Mémoires sur les Amputations, l'Hydrocèle du Cou, &c Genève. Paris, 1825. The Memorial was read before the French Institut in 1815; but the report upon it by Percy was not favourable.

(*c*) On Hydrocele of the Neck, with Cases and Observations; in Dublin Journal of Medical and Chemical Science, vol vi. p. 1. 1834.

(*d*) Case of Hydrocele of the Neck cured by Seton, with Observations; in Guy's Hospital Reports, vol. i. p. 105.

monly originate in the lower part of the neck, just above the collar-bone, of small size, but increase in bulk, covering the whole of that side, and even running across beneath the skin. Sometimes, however, they make their first appearance below the lobe of the ear, and get attached to the angle of the jaw. As they increase in size they interfere with swallowing and breathing. so as to cause severe cough and symptoms of suffocation. Fluctuation is distinctly felt, but they are not always transparent, as though sometimes the fluid they contain is clear and limpid, it is more frequently either like coffee or coffee grounds, which probably depends on the rupture of some little vessel into their cavity, under the exertion of coughing. Maunoir thinks that the cyst is thicker than in hydrocele of the testicle; and in one of the cases mentioned by Fleury (*a*), it was very hard and resisting, and its interior lined with a fibro-cartilaginous covering. In the Museum of the College of Surgeons, there is a specimen of one of these serous cysts removed from the front of the neck by Thomas Blizard; it is more than six inches in diameter; its walls thin and fibro-cellular; a portion of it passed behind the collar-bone, and it contained a clear brownish fluid. Also, another attached to the back of the tongue-bone, about two inches in diameter, which contained a brownish yellow, thick grumous, honey-like fluid, containing abundant crystals of cholestearine. Simple cysts are rare in the female breast, Brodie says he has seen but two; and in the Museum at St. Thomas's there is another. Perhaps here also belong Astley Cooper's (*b*) cellulous hydatids of the breast, of which, however, there are generally several in the same gland, as in the specimens in the College Museum. In the same collection there are also examples of a large cyst removed from the thigh, and of another which filled up the thyroid hole, projecting both into the *pelvis* and the thigh, and followed a kick on the part; both these cases were from females (*c*). A few years since I had a patient with a cyst on the auricle, which contained a thick brownish, but transparent glairy fluid; this filled again several times after being punctured, and was cured at last by stuffing with lint, and causing suppuration of the sac.

(2) It is probable that these so-called melicerous cysts merely differ from the former in the thicker nature of their contents.

(3) Atheromatous cysts sometimes contain a pultaceous white matter, like pap; or, as Home (*d*) has described it, "a small quantity of thick curd-like matter, mixed with cuticle, broken down into small parts." (p. 101.) Some such examples exist in the College Museum, stated in the Hunterian manuscripts to consist "principally of a series of cuticles thrown off," and "a flaky substance, which seemed to be a succession of cuticles, being the same with that which lines the cyst." Home also observes:—"Other cysts of this kind, instead of having cuticle for their contents, are filled with hair, mixed with a curdled substance, or hair without any admixture whatever, and have a similar kind of hair growing upon their internal surface, which is likewise covered with a cuticle." (p. 102.) I have seen in two or three instances these cysts filled with little bodies, semitransparent, and resembling grains of boiled rice flattened and packed closely together, which were probably scales of cuticle. Even teeth, more or less perfectly formed, have been found in a cyst in the orbit, as happened in a case related by Barnes (*e*) of Exeter.

(4) These are true productions of the sebaceous follicles, and have been already mentioned (*par.* 2198, *note*) in speaking of Horns.]

2250. The nature of the cyst is very various, and has no connexion with the size of the swelling. In those which contain serous fluid the cyst is generally thin and correspondingly transparent. The cyst is often very firm, tough, fibrous, may be separated into many layers from the outer surface, and often has an almost horny character. At many parts it is frequently found bony. The inner surface of the cyst is often smooth and shining; frequently has a velvet-like surface; is sometimes beset with true hairs; oftentimes it exhibits rather a muco-membranous structure, an irregular, folded, net-like surface. The connexion of the cyst with the surrounding parts is usually but slight, by means of delicate cellular tissue and few vessels; sometimes, however, a very firm connexion is

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(*a*) Annales de Chirurgie, vol. x. p. 377. 1844.

(*b*) Illustrations of Diseases of the Breast, London, 1829. 4to.

(*c*) Paget's Catalogue of the Pathological Collection in the Museum of the Royal College of Surgeons of England.

(*d*) Observations on certain Horny Excrescences of the Human Body; in Phil Trans., vol. lxxxi. p. 95.

(*e*) Med-Chir. Trans., vol. iv. p. 316. 1813.

found, and the cyst cannot be well distinguished from its immediate investments.

["Mr. HUNTER considers the internal surface of the cyst to be so circumstanced respecting the body, as to lose the *stimulus* of being an internal part, and to receive the same impression from its contents, either from their nature or the length of application, as the surface of the skin does from its external situation. It therefore takes on actions suited to such *stimuli*, undergoes a change in its structure, and acquires a disposition similar to the *cutis*, and is consequently possessed of the power of producing cuticle and hair. What the mode of action is, by which this change is brought about, is not easily determined; but from the indolence of these complaints, it most probably requires a considerable length of time to produce it. That the lining of the cyst really does possess powers similar to *cutis*, is proved by the following circumstances; that it has a power of forming a succession of cuticles like the common skin, and what is thrown off in this way is found in the cavity of the cyst. It has a similar power respecting hair, and sometimes the cavity is filled with it, so great a quantity has been shed by the internal surface." It is further added:--" What is still more curious, when such cysts are laid open, the internal surface undergoes no change from exposure, the cut edges cicatrize, and the bottom of the bag remains ever after an external surface. Different specimens of the above-mentioned circumstances are preserved in Mr. HUNTER's collection of diseases" (*a*).]

2251. Encysted tumours are at first always small, and developed slowly to a large size. Their form is generally round, and their extent well defined, if the surrounding parts do not affect their development in a decided direction. They are movable at their base; this, however, depends on the yieldingness of the parts surrounding them, and on their firmer or looser connexion with them. The manner in which an encysted swelling is filled differs, according to the nature of the contained substance and of the cyst; the swelling is elastic, expanded and yielding; a distinct fluctuation is often felt; sometimes it is firm; the skin covering it is unchanged. An encysted tumour, when it has reached a certain size, often remains stationary throughout life, sometimes it continues increasing slowly. Various symptoms may be produced by the pressure of the swelling upon important neighbouring parts; if on a bone it will destroy it by continued pressure. Nutrition may also be interfered with by several encysted tumours.

2252. Sometimes, in consequence of external violence or from unknown causes, the encysted tumour inflames, and pours into its cavity a puriform fluid. The external skin reddens, and ulcerates, the cyst bursts, and the fluid contained in its cavity is discharged. If the inflammation be severe, the membrane forming the sac is loosened into cellular tissue, thrown off, and thus a perfect cure is effected. But this part often remains ulcerated, and very sensitive; an ichorous ill-conditioned pus continues to be discharged; fungous growths spring up, and the aperture obstinately resists healing.

2253. Encysted tumours are to be considered consequences of an unnatural formative effort, of which the proximate cause is, in most cases, not to be determined. They are frequently congenital, and then form a peculiar kind of *nævus maternus;* sometimes they are hereditary; frequently arise in consequence of rheumatic, gouty, syphilitic, or scrofulous disease; sometimes from external violence, continued pressure, and the like. They may occur on all parts of the external surface of the body, but are most commonly developed where naturally the cellular tissue is in largest quantity.

2254. A peculiar kind of encysted tumour, which most commonly

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(*a*) HOME, above cited, p. 102.

occurs under the skin of the head and face, and upon the back, though but rarely in other parts, has been subjected to particular inquiry by Astley Cooper (*a*), who has fixed its origin in the obstruction of a sebaceous follicle of the skin, in which case the tallow-like sebaceous matter collects in its cavity, and its walls expand in the cellular tissue (*Tumor sebaceus.*) The form of this swelling is mostly globular; it feels firm upon the head, but on the face fluctuates indistinctly. It often presents, at the beginning, a dusky spot in its middle, which is the plugged-up mouth of the follicle, and from which the contained matter may often times be squeezed (1). When it has attained its ordinary size, from one to two inches in diameter, it sometimes suddenly subsides, again begins, increases, and acquires its previous size. It contains a substance similar to coagulated albumen, which, when the tumour suppurates, stinks horribly. It is rather less movable than the common encysted tumours, and is more firmly connected with the skin. Sometimes the cyst contains hair; sometimes the swelling ossifies (2). Horny excrescences frequently spring from these tumours; the horn begins growing at the open part of the cyst, is at first soft and flexible, but soon acquires considerable hardness, and assumes the nature of horn (*b*). The structure of the cyst varies; on the face it is usually thin, thicker on the back, and thickest on the head; it also acquires greater thickness in proportion to the length of time it has existed. On its interior the cyst is lined with an *epidermis*. When bodies have been artificially introduced, the cyst presents many but minute vessels. Pressure is a frequent cause of this swelling; also a diseased state of the secretion, a deficiency of its wonted fluidity, a thickness of the substance secreted in the follicle, and flaccidity of its walls. I have seen a considerable number of such swellings after the suppression of an eruption on the head. They frequently seem to be hereditary.

[(1) The most simple form of sebaceous tumour, or, more properly speaking, *Sebaceous accumulations*, as they are called, by Erasmus Wilson (*c*), is that commonly seen on the sides of the nose, and also upon the face in unhealthy persons, and not unfrequently also on the shoulders and back, often in very considerable number, varying in size from that of a pin's head to a pea, the tops of which becoming blackened, have given rise to their vulgar name "black heads." Sometimes they lie quiet, giving to the face a dirty ugly appearance; but if a little gentle pressure be made on either side, the substance of which they consist oozes out like little yellowish white worms or maggots, by which name they are also not unfrequently called, of various length and size, according to the length and distension of the sebaceous follicle. Sometimes they acquire considerable size; Astley Cooper mentions that he himself had one on the lower part of the dorsal *vertebræ*, which had acquired a diameter of about two inches, and had a small black spot in its centre, which having been picked off, he squeezed out a large quantity of sebaceous matter. Sometimes these collections, not being rubbed out, as they frequently are after washing, or not having been purposely squeezed out, inflame the follicles, and thus *acne* is produced, which commonly terminates in suppuration, covering the face and back with repeated crops of pimples, especially annoying to females.

Astley Cooper considers the encysted tumours formed on the head and back to arise merely from obstruction of the sebaceous follicles, and this opinion is generally held. But I have great doubt of its correctness, for such cysts are always complete sacs, without the least appearance of ever having had any opening; they may be rolled about very freely beneath the skin, to which they are so loosely attached, as well also as to the cellular tissue, that after cutting carefully through the skin, they may generally be shelled out by running a probe around them, unless having by their size irritated

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(*a*) Astley Cooper; in his and Travers's Surgical Essays, part ii. p. 229.—Baersch, (Præs. Reichel,) Dissert. de Tumoribus Capitis tunicatis post Cephalagiam exortis. Lipsiæ, 1765.—von Walther, Ueber die Balggeschwülste; in Journ. für Chirurg. und Augenheilk., vol. iv. p. 379.

(*b*) This subject has been already considered in treating of Horns.

(*c*) Above cited.

the surrounding parts, they have become adherent to them, and specially to the skin, which by degrees yields to their pressure, and ulcerating, they burst, as the cyst itself, though sometimes as thick as a shilling, tears very easily, and may be split into flakes resembling recent fibrin. If left to themselves, after bursting, these cysts produce troublesome sores, which continue till the cyst either comes away or is pulled away piece-meal, and then the sores heal. But nothing of this kind happens when the swelling is formed by an obstruction of the mouth of the follicle; the follicle either yields to the accumulating sebacin, and enlarges till, as in Astley Cooper's own case, it acquires considerable size, but can be emptied by gentle pressure of its contents, and nothing further happens beyond the recollection of the sebacin. Or the follicle inflames and suppurates, forcing out with the pus the little mass of hardened sebaceous matter, after which the inflammation quickly subsides, and the follicle resumes its natural office, without, however, anything which has the least pretension to a cyst having been discharged. It, therefore, seems to me that from the different courses these two forms run through, they are of decidedly different nature. To this it may also be added, that the tumours resulting from obstruction of the follicles, have occasionally their contents converted into a projecting horn, in the way which Erasmus Wilson has described, as already noticed; but so far as I am aware this never happens when the cyst is globular, close, and of the recent fibrous character which I have noticed, and which is almost invariably seated in the scalp.—J. F. S.

(2) The ossification of an encysted tumour or of its contents is very rare; Dalrymple (*a*), however, has mentioned an example of "a small tumour, which he removed from beneath the tarsal cartilage of the upper eyelid of a middle-aged man, which instead of the usual cheesy matter contained an apparently earthy or bony deposit. This tumour was somewhat larger than a pea, and composed of concentric layers of hard earthy material, and in form, was rounded, except at the surface immediately behind the *conjunctiva*, where it was somewhat flattened and rough. * * * Upon examination by the microscope, the concentric layers of this tumour were found composed entirely of *epithelium* scales, closely agglutinated together; but instead of the usual transparent and thin *lamina* with its central *nucleus*, they were thickened and hard, and contained granular earthy molecules, which could be removed by immersion in weak muriatic acid. No amorphous earthy deposit existed around or among the scales, but the whole was composed of this *epithelium* opaque, of a light-brown colour, with a clear and large central *nucleus*." (pp. 238, 39.)]

2255. To encysted tumours *Ganglia* (*Ueberbeine*, Germ.) are allied; they are round, of slow growth, rarely exceeding the size of a pigeon's egg, and in general, consisting of thick-walled cavities, developed in the neighbourhood of joints and sheaths of tendons, containing a fluid similar to *synovia*, with a greater or less number of little white cartilage-like bodies; in some cases, they must be considered as partial expansion of the tendon sheaths, but more generally as actually new productions (*b*). They commonly arise from external violence, pressure, violent straining of a tendon and the like, on which account they are most frequent on the back of the hands and feet; in some instances, they seem to originate from constitutional causes. As long as the swelling is small, it produces no inconvenience; but when it acquires large size, it interferes with motion; and if it inflame and suppurate, tiresome ulcers are produced (*c*).

2256. The *cure* of encysted tumours is effected in various ways, the choice of which depends on their seat and size, their mode of connexion with the neighbouring parts, their mobility or immobility, the nature of the coverings of the swelling, and the excitability of the patient. These modes of treatment consist, *first*, in the dispersion of the swelling; *second*, in its complete or partial removal with the knife; *third*, in its removal with the ligature; *fourth*, in opening the tumour and destroying the cyst. Many cases require a combination of these modes of treatment.

2257. *For the dispersion of encysted tumours*, volatile rubbings, blisters, dispersing plasters, escharotics, and a multitude of other reme-

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(*a*) Med.-Chir. Trans., vol. xxvi. 1843.

(*b*) Meckel, above cited, p. 158.—J. Cloquet; in Archives Génér. de Médec. 1824. vol. iv. p. 232.

(*c*) *Ganglia* have been already noticed at p. 459 of this volume.

dies have been recommended. Although it cannot be denied that, in some cases, absorption of the fluid contained in the cyst has been effected by them; yet, however, these remedies do not produce a radical cure as the cyst remains, and except such inflammation take place that the whole cyst be destroyed and thrown off, no cure is effected. This method is therefore inefficient, and not to be recommended.

2258. The *removal of encysted tumours with the knife*, is in general the most fitting mode of treatment, if the nature and seat of the swelling permit it without danger of severer injury. The mode of proceeding varies. If the tumour be seated on a thin stem, an assistant draws back the skin around it, and the operator removes the tumour at its base with one or more strokes of the knife. By drawing back the skin, as much of it is preserved as is sufficient to cover the wound and allow the bringing together of its edges. If the tumour be not large, the skin movable upon it and natural, a longitudinal cut should be made through the skin, the ends of which should reach a few lines beyond the circumference of the swelling. The edges of the wound are then separated from the cyst with the blade or handle of the knife, or with the finger, carefully avoiding injury of the cyst, which being seized with a hook and lifted up from the bottom, is to be cut off cautiously with some strokes of the knife. If the skin upon the swelling be diseased, or if the tumour be of very large size, it must be included in two semilunar cuts at a proper distance from its base, so as to preserve sufficient skin for covering the wound. Whilst the cyst is being isolated, an assistant should constantly sprinkle cold water on the edges of the wound or sop up the blood with a moist sponge. If the vessels spirt forth, they must be compressed with the finger, and tied after the operation is completed. If the cyst be wounded and the fluid escape, it is difficult to remove it entirely. If it be firm and hang loosely, it may be torn out with the forceps. When the whole cyst has been removed, it must always be endeavoured to bring the edges of the wound together and produce union. But, in cases, where the cyst has been removed only on one side, where the parts are very lax and yielding, the extirpation is difficult, and many cuts must be made in various directions, the wound filled with lint, and its edges only drawn together when the bottom is covered with granulations.

2259. *Tying the encysted tumour*, applies to those cases in which the vessels running to the swelling are very large and numerous, and great danger of severe bleeding is to be feared; or when extirpation is dangerous on account of the neighbourhood of important organs, especially blood-vessels. The tumour is to be tied immediately at its base, if that be not too broad, or a cut is first made in the skin at the base, and in this, a ligature applied with a loop-tier, and daily tightened till the tumour come off. This method is always very tedious, accompanied with much, often very great pain, and when the swelling begins to putrefy, the stench is often unbearable.

2260. *Opening the cyst, and removing it by suppuration or with caustic*, is performed in different ways. *First.* In many cases when the connexion of the tumour with the neighbouring parts is not very firm, it is sufficient to cut into the swelling with either a single longitudinal or with a crucial cut, to empty its contents and fill it with lint till suppuration come on, when the loosened cyst can be removed either piecemeal or entire. *Second.* The tumour is opened with a lancet, or with caustic, by applying oil of vitriol, or butyr of antimony, and scratching the skin with a needle till the cyst be penetrated, then its contents are emptied, and for some days its interior must be irritated by frequently introducing a probe or touching it with either of the just-mentioned escharotics, after which the cyst separates and can be removed. *Third.* A seton, smeared with some irritating ointment, may be passed through the greatest diameter of the tumour to produce the separation and death of the cyst. *Fourth.* The swelling may be punctured with a trocar, its contents allowed to flow through the canula, and some irritating fluid injected and allowed to escape, when the swelling has been filled and become painful. Soothing poultices are then applied, and when the swelling is soft and fluctuating, an opening must be made through which the pus usually collected in the cyst escapes. These modes of treatment as well as the ligature, may be employed under the same circumstances, and especially when the cyst is not very thick. I have often made use of the first and second methods in encysted tumours of the face, and frequently after emptying have pulled out the cyst; they have the advantage of leaving a smaller scar than that of extirpation (*a*).

2261. When the tumour has its roots very deeply seated among important parts, which must be injured by complete removal, a mixed treatment must be had recourse to. *First.* The cyst must be laid bare at its base as far as possible, without injuring any important vessel, a ligature applied around, and the tumour cut off in front of it. *Second.* As much of the cyst must be removed as can be done safely, and the remainder destroyed with caustic. *Third.* The cyst must be opened, filled with lint, and when it begins to crumple together, it must be attempted to separate it from its bed. *Fourth.* When the root of the tumour cannot be got at without a dangerous wound, it must be isolated as far as possible, drawn up, and a ligature applied with a loop-tier. These mixed modes of proceeding are very often required in encysted tumours of the neck (*b*).

2262. Encysted tumours caused by stoppage of a sebaceous follicle, may at first, when the follicle is merely a spot filled with blackish hardened tallow-like substance, be emptied by introducing a probe into the stopped opening, and then squeezing out the substance. If force be requisite to squeeze it out, it is better to enlarge the opening with a cut. Frequent squeezing prevents the refilling of the follicle. The removal of these tumours from the head is not always free from danger. It is, however, unnecessary to dissect them out, unopened; a cut may be made, the contents emptied, the cyst seized with a hook or forceps, lifted up, and separated (1). When a horny growth has been formed in the follicle, it will be necessary, to prevent its recurrence, to remove the cyst with the horn (*c*).

[(1) As I have already mentioned, these cysts upon the head, if not adherent from inflammation, will readily shell out, if the skin only be cut through; and it is more convenient to remove them whole, than after opening them as CHELIUS recommends.—J .F. S.]

2263. The *treatment of ganglions* must be guided by their condition. If still recent, their dispersion should be attempted by rubbing in volatile ointments, or turpentine, by repeated application of tincture of iodine, by the use of mercurial and hemlock plasters, by blisters, by constant pressure with a metal plate and tight bandage, and the like. If they will not be so dispersed, and the cyst be thin, its subcutaneous rupture may be attempted

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(*a*) ERDMANN; in Zeitschr. für Natur und Heilkunde, vol. i. part iii. p. 304.

(*b*) BRÜNNINGHAUSEN, Ueber die Exstirpation der Balggeschwülste am Halse und über eine neue Methode dieselbe mit Sicherheit zu verrichten. Würzburg, 1805.

(*c*) ASTLEY COOPER, above cited, p. 241.

by pressure with the thumbs, upon which the fluid escapes into the cellular tissue, and by continued application of pressure is prevented collecting again; this practice I have usually employed with success (1). When the cyst is more tough, it is best, after drawing the skin aside, to open it with a puncture, squeeze out its contents, and then allow the skin to return to its place, so as to prevent the entrance of the air, and to effect the union of the walls of the cyst, and hinder the return of the complaint by careful bringing together, and by the continued use of moderate pressure. For the purpose of more certainly preventing the entrance of the air, the subcutaneous puncture (*a*) has been recommended; in doing this, the skin is drawn back, and a cataract-needle thrust obliquely into the swelling, the fluid pressed into the cellular tissue, and a bandage moistened with lead wash applied; and on the refilling of the sac this operation must be repeated. As with these various methods the return of the ganglion is still not unfrequent, it has been advised, in addition to the subcutaneous puncture, to cut through the walls of the cyst in every direction. According to Barthelemy (*b*), the skin having been raised in a fold, the point of a thin lancet, an inch long, curved towards the handle of the instrument, and having a cylindrical stem, should be introduced, and thrust forward, so as to divide the ganglion into halves; and the instrument then carefully withdrawn, to prevent the entrance of the air. The contained fluid escapes into the cellular tissue, and disappears under the use of a proper compressing bandage. Malgaigne (*c*), after making the swelling tense, penetrates it with a straight narrow bistoury, flat and parallel to the skin, at the lower broadest part of the tumour, so far that the point of the bistoury passes through the upper part of the cyst without wounding the skin. He then turns the blade on its back, and thus keeps the lips of the little wound asunder, for the purpose of emptying the fluid, which is also assisted by pressure. After this the knife is again laid flat, and its point made to describe a quadrant on the left side of the swelling, so as to cut through every thing beneath the skin, and extend a little beyond the bounds of the *ganglion.* The knife is then turned to the right, and the same done there. To conclude, the point of the knife is pressed down, and carefully carried through the bottom of the cyst, so as to avoid injuring the tendons beneath. The swelling is now squeezed to empty all the *synovia*, and then covered with pieces of sponge and compresses, or with pasteboard, to keep up regular pressure. According to Hennemann (*d*), an assistant should place the tip of his right finger firmly on the skin beyond the ganglion, and draw it towards him as much as possible, to prevent the parallelism of the wounds, whilst the operator holding Dieffenbach's tenotome, like a pen, places it nearly perpendicularly close to the tip of the assistant's finger, at the lower part of the tumour, thrusts it in, sinking the handle more and more, to the farthest and innermost part of the cyst, in the axis of the limb. Then with the left forefinger, the extremity of which must be guarded with a piece of lint to prevent it being wounded, he finds the point of the knife, and raising the handle a little, thrusts it as deeply as possible into the bottom of the *ganglion*, and completely throught it into the cellular tissue beneath, and brings it back still accompanied by the finger uninterruptedly, cutting upwards and outwards towards the puncture, but without wounding the

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(*a*) Cumins; in Edinburgh Med. and Surg. Journal, vol. xxiv. p. 95. 1825.

(*b*) Gazette Médicale de Paris, vol. iii. p. 773. 1839.

(*c*) Bulletin de Thérapeutique. Jan. 1840. p. 39.

(*d*) Ueber eine neue Reihe subcutaner Operationen, p. 145. Rostock und Schwerin, 1845.

skin. He then places the blade of the knife flat as at first, and divides the sac horizontally right and left. This done, a piece of whalebone as thick as paper, and barely a quarter of a line broad, is passed in upon the blade of the knife, so as to keep up the constant escape of the *synovia;* this is properly fixed, and a cold wash applied. On the fourth day the whalebone is removed, and pressure made, which if the patient can bear it, should be continued for eight days. Further experience is requisite to decide whether by this mode of subcutaneous division, the return of the *ganglion* is more certainly prevented, than by mere puncture, and whether more serious symptoms are not to be dreaded. It must not be forgotten that the principal object in this mode of treatment, is most carefully to prevent the entrance of the air into the cyst, but this, with the various turnings and movements of the knife, &c., seems scarcely possible.

Extirpation of the *ganglion*, which may be necessary if its walls be very thick and tough, and the above-mentioned plans have been unsuccessful, must be performed in the same way as removing encysted tumours, and with great care, that none of the tendons are wounded. The edges of the wound must always be brought together as closely as possible to prevent the admission of air (2).

[(1) It is not often that a *ganglion* can be broken by pressure with the thumbs; but it may in general be managed by a smart blow with a book or a piece of flat board.

(2) I can hardly think the removal of a *ganglion* ever needed, and should be very sorry to undertake such operation.—J. F. S.]

XI.—OF HYDATIDS.

(*Hydatis*, Lat.; *Hydatiden*, Germ.; *Kystes hydatiques*, Fr.)

Schroeder, Th. G., De Hydatibus in corpore animali, præsertim humano repertis. Rintelii, 1790.

Lüdersen, De Hydatibus. Gottingæ, 1808.

Laennec; in Bulletin de la Faculté de Médecine, No. 10. 1805.

Rudolphi, Entozoorum, seu Vermium Intestinalium Historia naturalis. Amstelodami, 1808-10.

Bremser, Ueber lebende Würmer im lebenden Menschen. Wien, 1819.

Cruvelhier; in Dict. de Médec., vol. i. p. 465, Article, *Acephalocystes.* Paris, 1832.

2264. *Hydatids*, in some respects, range with encysted tumours; they occur as roundish, oval, or otherwise shaped serous vesicles, containing lymph, either singly or collected together in the different organs of our body, either loose in the cavities, or surrounded with a second covering, which connects them with the surrounding parts. These hydatids are living animals, as shown in part by their having decided organs, and being capable of self-motion, nutrition, and reproduction, (Rudolphi,) and, in part, that they are quite loose and unconnected with the covering by which they are surrounded. These hydatids are divided into two classes; *first*, those in which, besides their bladder-like expansion, decided organs are observed, *Cysticercus*, *Cœnurus*, and *Echinococcus*, of which the first and last only are met with in man; *second*, those in which no other organ besides the vesicle has been discovered, as the *Acephalocystides.*

2265. The *Cysticercus Cellulosæ* (*Blasenschwanz des Zellgewebes*, Germ.) is met with in the cellular tissue of the organs, between the several layers of muscles, in the brain and its vascular network, beneath the *conjunctiva*, in the chambers of the eye floating in the aqueous humour, and the like. Its size is that of a pea or bean, is most commonly elliptical, rarely globular, and consists of a delicate bladder filled with serum, on which the retracted extremity of the head may be distinguished as a dusky body, but can be projected by squeezing; and its quadrangular shape with four suckers, and a conical trunk, armed with a double row of hooks, are then observed. The neck is short and narrower than the head, and the part next the vesicle.

2266. The *Echinococcus hominis* (*Hülsenwurm*, Germ.) attains the size of a walnut, and even that of the fist, occurs for the most part only in the organs of reproductive life, and presents in its interior, numerous little worms as big as grains of sand or of millet seed, on each of which, if examined with the naked eye, may be perceived a single circle of hooks and suckers.

2267. The *Acephalocysts* exist as large or small vesicles, from the size of a lentil to that of a child's head, and of various number and colour. Where developed, they are always surrounded with a more or less tough *membrane*, in which are found bladders of different number. This membrane is generally very firm, sometimes at certain parts fibrocartilaginous, cartilaginous, or even bony, and its thickness proportionate to its size, and the time it has existed; it is often closely connected with the surrounding parts, especially in parenchymatous organs, sometimes only loosely so, when in the midst of an organ having much cellular tissue, or when in the neighbourhood of a cavity. The inner surface of this membrane is lined with another membrane, frequently smooth, sometimes uneven, which exhales a transparent, limpid, yellowish, purulent, thick, turbid fluid, in which the hydatids swim singly or in great number, even as many as up to 700 or 800. The membrane of the hydatid itself is elastic, extensible, contracts after its contents are emptied, is sometimes so delicate that it tears with the least touch, and sometimes thick and capable of being separated into four or five layers. It is never attached to its covering. The fluid in it is commonly as limpid as pure water, except that it contains a certain quantity of *albumen;* it has for the most part the same appearance as that of the covering in which it is contained; it has, however, been found transparent, whilst that of the membrane was purulent.

2268. Acephalocysts are developed in all organs, in the liver, ovaries, brain, kidneys, lungs, muscles, bones, and the like, and the danger of the disease depends on the importance of the organ. Their symptoms are always indecisive, and afford a more or less probable conjecture; also when they have been once present in an organ and been voided, the same symptoms may recur (1). Only when such swellings are quite superficial, they may, perhaps, be distinguished by their unequal fluctuation, and on closer examination with the cold hand by their peculiar movement. Sometimes in such swelling, a peculiar feel of rubbing, a kind of quivering on touching this vesicle in the examination to discover fluctuation, may be perceived. Many have doubted this; PIGNÉ has, however, twice noticed it, and considers it a decisive character (*a*).

(1) Thus pain in the region of the kidney has been observed, and the escape of a quantity of hydatids with the urine; then follows a cure, till the symptoms set in again and announce the speedy discharge of hydatids (*b*).

[I have seen two examples of acephalocysts; the first was in the left side of the neck, immediately above the collar-bone, between the sternomastoid and trapezial muscles, in a boy about six years old; it was about the size of a hen's egg, transparent, and unattended with pain; its true nature was not known, and it was supposed to be merely a

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(*a*) In his Translation of this work.

(*b*) VIGLIA VALLEX; in Bulletin de la Société Anatomique de Paris, p. 3. 1830.

watery cyst. A puncture was made in it, and about an ounce of clear fluid discharged; the lips of the wound were brought together, and it soon healed But in the course of three or four days, the part again swelled, the skin inflamed, suppuration took place, the wound opened, and a portion of the supposed cyst protruded, which being gently drawn out, was found to be an acephalocyst; a cure soon followed. The second case had several of these animals, each contained in its proper cyst in the cavity of the belly, and attached to the doublings of the *peritonæum;* one of them, large enough to contain a pint of fluid, was situated between the base of the bladder and the *rectum*, and filled up the cavity of the *pelvis*, thrusting the bladder upwards above the *symphysis pubis*, and by the pressure it made on the lengthened neck of the bladder, causing retention of urine, for the relief of which, it was necessary to cut into the *perinæum*, when the urine was drawn off; but the catheter continually failed in the performance of its duty till an enormously long one was passed; the patient suffered much, and died in about a week, when the cause of difficulty was explained by the position of the acephalocyst, as above mentioned.—J. F. S.]

2269. The mode of development of these hydatids is unknown; when existing in large quantity, they are often produced anew, of various number and size, in the cavity of each hydatid. They not unfrequently occur after external injury, as blows, falls, and the like; frequently, however, without any external cause. What internal diseased action is under these circumstances operating is unknown. They frequently die; the fluid then loses its transparency, thickens, and becomes yellow; the vesicle crumples up, and the thickened fluid is changed into a fat-like or earthy substance. The membrane often inflames, fills with pus, the vesicle dies, and its remains swim in the pus. Sometimes they make their way into an excretory duct and are discharged; sometimes into a serous cavity, where they quickly excite fatal inflammation. When enclosed in a bone, they so thin its substance that fracture occurs on the slightest occasions, as DUPUYTREN observed in the upper arm, and WICKHAM in the shin-bone (PIGNÉ.)

[There is in the Museum at St. Thomas's an excellent example of acephalocysts filling the medullary cavity of the upper arm. The bone had been broken probably from its having been weakened by the absorption of its shell, from the pressure of these animals; the fracture could not be made to unite, and after various attempts to that object, amputation was decided on, and performed by BOOTT of Lincoln; the saw had not penetrated a quarter of an inch when the bone snapped beneath it, and out gushed a heap of acephalocysts; the shell of the bone was generally thin as writing-paper. The patient recovered.—J. F. S.]

2270. The *treatment* of hydatidous swellings, when external, simply consists in their removal. In doing this, the thin vesicle is generally torn; the remains must be removed with COOPER's scissors, and the wound cured by suppuration, in which, whatever remains is thrown off during that process. If the hydatid be removed uninjured, it shows evident movement, when put in warm water.

The swellings which are considered serous and hydatid-like, and containing in their interior a varying number of cartilaginous bodies, and especially developed on the wrist- and ankle-joints, and which I consider, as diseased changes of the mucous bags, have been already treated of (*par.* 1870.)

XII.—OF CARTILAGINOID BODIES IN JOINTS.

(*Mures in Articulis, Corpora seu Concrementa fibrosa seu cartilaginea Articulorum*, Lat.; *Gelenkmäuse*, Germ.; *Corps cartilagineux des Articulations*, Fr.)

PARÆI, Opera, lib. xxi. cap. xv.

MONRO; in Medical Essays and Observations of Edinburgh, vol. iv. p. 244.

SIMSON; in same, p. 246.

REIMARUS, De Tumore Ligamentorum circa Articulos, Fungo Articulorum dicto. Leid., 1757.

FORD, EDWARD; in Medical Observations and Inquiries, vol. v. p. 329.

HOME, EVERARD; in Transactions of a Society for the Improvement of Medical and Surgical Knowledge, vol. i. p. 229.

DESAULT; in his Œuvres Chirurgicales, vol. i. p. 288.

BIERMANN, (Præs. HEILMANN,) Dissert. de Corporibus juxta Articulos mobilibus; subject. Observ. Wirceb., 1796.

ABERNETHY, JOHN, On the Removal of loose substances from the Knee; in his Surgical Works, vol. ii. p. 213.

GÜNTHER, Dissert. de Muribus in Genu. Duisb., 1811.

LANDER, Einige Bemerkungen über die beweglichen Concremente in den Gelenkkapseln; nebst zwei Beobachtungen über die Ausschneidung solcher Körper aus dem Kneigelenke; in VON SIEBOLD'S Chiron, vol. ii. p. 359.

LARREY, Notice sur les Cartilages mobiles et contre nature des Articulations; in his Mémoires de Chirurgie Militaire, vol. ii. p. 421.

SCHREGER, Beobachtungen und Bemerkungen über die beweglichen Concremente in den Gelenken, und ihre Exstirpation. Erlangen, 1815.

KÖHLER, Dissert. de Corporibus alienis in Articulis obviis. Berol., 1817.

HANCKE; in VON GRAEFE und VON WALTHER'S Journal, vol. xxvii. pt. ii. p. 449.

2271. *Cartilaginoid bodies* are sometimes formed within the capsules of joints, and are either loose in the cavity, and can change their place in every direction, or are attached to the capsule by a neck, and vary considerably in regard to their nature, size and number.

2272. These bodies are most commonly noticed in the knee-joint; but they have been seen in the ankle- elbow- jaw- shoulder- and wrist-joints. They have generally an oblong flattened form, with rounded edges, and a smooth glossy surface; they are, however, met with round, flat, and even very irregularly shaped. Sometimes they are very soft, frequently almost cartilaginous, sometimes bony, but much more commonly cartilaginous and bony together, and then have a bony *nucleus*. Such as are quite loose have often a peculiar, completely unorganized, appearance; are rough, granular, and have the exact shape of the space they occupy. These bodies vary in size from that of a grain of hemp to that of an almond, and larger; the ordinary size is that of a large bean. In general there is only found one such body, though frequently several and even a great number. I have seen in one person three, and in another two.

2273. The *symptoms* which these foreign bodies in the cavities of joints produce, vary according to their size, form, seat of their development, and according as they are loose in the joint, or still attached by a neck. If such body be not large, and if it be developed in that part of the joint where it is unaffected by the rubbing together of the ends of the bones, and if it be attached by a short stem, it may exist for a great length of time without producing any symptoms; but if the stem to which the body is attached be longer, so that in the different motions of the joint it get between the ends of the bones, violent pain and sudden incapability of moving the joint are produced, which symptoms do not cease till the foreign body have again escaped from between the bones. The slightest motion is often sufficient to cause this pain. So long as it remains attached by the stem, can the patient precisely point out where it gets between the ends of the bone. In the knee-joint these bodies are generally found on one or other side of the knee-cap, and can be distinctly felt and pushed forwards. If the body be quite loose, its position is very variable; it gets into different parts during the various movements of the joint; and even the patient himself can, by pressure on the joint, and by some particular movement, push it into any position he pleases. These symptoms arise either gradually after previous violence, which has been followed by consequent inflammatory swelling of the joint, or when, without any injury there has been more or less severe pain, with or without swelling, and which is commonly taken for a rheumatic affection. Frequently the pain connected with these foreign bodies is very severe and constant, and accompanied with inflammatory swelling of the joint, or an excessive accumulation of *synovia*.

The symptoms which these concrements, when not appearing externally, cause, may be easily mistaken for an arthritic or rheumatic affection. The diagnostic characters of the former are, when besides the patient having never been subject of those *diatheses*, the pain comes on suddenly, and immediately after moving the joint; and when the attacks have already frequently occurred after any decided movement, if it subside whilst the joint is kept perfectly at rest in a certain posture; if it return on motion, or the slightest attempt at changing position, neither day-time nor the state of the atmosphere influencing it; when the swelling is dissipated by rest, but the movements are not proportionally more free; and lastly, when the patient, who has already suffered these symptoms, again recovers the free use of the joint immediately after some accidental movement (*a*).

2274. The commencement of these cartilage-like bodies in joints, is commonly, but not always, preceded by external violence Opinions vary considerably in regard to their peculiar mode of formation. Some persons (REIMARUS, MONRO) think they are pieces of cartilage broken off; THEDEN (*b*) believes them to be the joint-glands torn off by violence; BICHÂT holds them for a change of a portion of the synovial capsule into cartilage; HUNTER (*c*) supposes them to have been originally extravasated blood which has become organized, and assumed the nature of the part with which it was connected; SANDER (*d*) holds them to be precipitates from the *synovia;* LAENNEC is of opinion that these bodies are formed on the outer surface of the synovial membrane, and gradually press into the cavity of the joint, the synovial membrane with which they are covered yielding and forming a stem by which they are attached. This stem is, in consequence of the displacements the foreign body suffers, torn through, and the body is then found loose in the joint. RICHERAND (*e*) imagines that some of these bodies are *organic* formations, vicious growths of the synovial membrane, whilst others on the contrary are *inorganic* concretions. SCHREGER is of like opinion, and considers the *inorganic* as the result of plastic matter deposited on the exterior, and either a new formation, which increases, according to the laws of elective attraction, from the unnaturally mixed *synovia*, or as incrustations, to which their lamellar structure upon a section through them leads, of which sometimes *coagula* of lymph, sometimes parts of the natural apparatus of the joint, form the base. Here also belong those bodies which, previously connected by a stem, have been detached, as after that the organic vegetation ceases, and their increase is subjected to the laws of general attraction, so that they are built up of homogeneous matter from the surrounding fluids of the joint. The origin of *organic* after-products, depends on a change of the chemical relations of the joint set up by dyscrasy, or mechanical violence; they are living growths of the glandular fat-apparatus, of the cartilage overspreading the joint-surfaces of the bones, even of the joint-surfaces themselves; they are in general of a tophical nature, sometimes sarcomatous, or penetrated with masses of bone; those become bony which spring from the bone; they are attached either firmly or loosely by their base,

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(*a*) SCHREGER, above cited, p. 14.

(*b*) Neue Bemerkungen und Erfahrungen, vol. i. p. 99.

(*c*) HOME, above cited, p. 232.

(*d*) In Dict. des Sciences Médicales, vol. iv. p. 127, Article *Cartilage*.

(*e*) Nosographie Chirurgicale, vol. ii. p. 349. Fifth Edition.

or are entirely loose, though on account of their rough surface they can never be so movable as the inorganic concretions. The joint is in these cases always more or less inflamed, or even the subject of actual degeneration; whilst, on the contrary, the formation of the inorganic concretions, little, if at all, interferes with the integrity of the joint.

[In St. Thomas's Museum there are several examples of these foreign bodies from joints and ganglions, which support HUNTER's notion of their formation. In one, there are numerous small flattened discs, not exceeding a pea in diameter, which were evacuated from a swelling on the back of the hand that had probably been part of a tendon-sheath, and had inflamed. They are composed of fibrin or *albumen*, and have hollow centres. In another, in which many little bodies were in the wrist-joint about the size of flattened peas, their surface has a cartilage-like appearance, and, when cut through, their substance is seen to consist of concentric layers of fibrin, with a small central hollow. In other preparations of larger size the central hollow has disappeared, and the whole mass seems homogeneous, and resembles cartilage. There is also a fine example of the result of synovial inflammation of the knee-joint, in which a large portion of the cartilaginous covering of the joint-ends of the bones has been destroyed; but on several parts of the synovial capsule numerous bunches of grape-shaped growths, with more or less thick stems, have formed, and one of these as big as a bean has become detached, and is loose in the cavity of the joint. I do not think, however, that this condition can be fairly taken as an example of the ordinary mode of production of loose cartilages, though it certainly explains the process very well.—J. F. S.]

2275. Of these several opinions LAENNEC's seems best to point out the progressive growth of these bodies; and to show the relation between them and those bodies, which are in like manner developed on the surface of the testicle and its vaginal tunic, and are sometimes firmly attached, sometimes quite loose. It is perhaps also not improbable that those foreign bodies in joints which have not a trace of membranous covering, whose surface is rough, powdery, their texture rather lamellar, and which have the form of the space in which they are lodged, are produced in the same manner, and that their previous structure is only changed by the rubbing of the joint-surfaces, after they have been long contained in the joint from which they have separated.

In other respects LAENNEC's opinion is not to be considered generally satisfactory, inasmuch as experience has proved that portions of the joint-cartilages are detached, or little *exostoses* formed around these cartilages, and may be broken off by accident (*a*); although REIMARUS and others incorrectly assume this as the general mode of their origin, which MORGAGNI has denied, since the erosions frequently observed on the cartilaginous surfaces have no connexion at all with the origin of these bodies, which are in general of spherical form, and greater thickness than the joint-cartilages. Whether these bodies still grow after their detachment, and increase by the attraction of certain parts of the *synovia*, is not to be contradicted; the opinion, however, is doubted by many (*b*). Many of these bodies are certainly formed by concretion of the *albumen* in the *synovia*, and are to be placed in the same rank with the foreign bodies which occur in great numbers in the mucous bags.

2276. When these foreign bodies cause severe symptoms, lie at some accessible part of the joint, or can be brought and fixed there, the most certain remedy is their removal, by opening the capsule of the joint. The serious and even fatal symptoms which have been noticed after small wounds into joints, and not unfrequently after this operation, have led to the preference of fixing these bodies to some one part of the joint by close

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(*a*) BRODIE; in Med.-Chir. Trans., vol. iv. p. 276. —SCHREGER, above cited, p. 8.

(*b*) SAMUEL COOPER, On the Diseases of Joints, p. 34. London, 1807.

bandaging, and so to prevent their getting between the joint-surfaces, and thus causing pain. Although in many cases these bandages are of no use, and even increase the pain, yet should they be tried, as in several instances they effect not merely momentary but permanent relief.

2277. Before the operation is performed, it must always be ascertained, by careful examination, whether there be not several such bodies in the joint. If the joint be painful and inflamed, this must first be got rid of by strict rest, leeches, cold applications, and the like. SCHREGER, in reference to the above-mentioned division of foreign bodies in joints, observes, regarding the *prognosis*, that in the first kind of these concretions the operation produces no dangerous reaction, when the structure of the joint is healthy, or at least its interior life is not affected; but in the second form, their removal is useless, and accompanied with dangerous symptoms (*a*).

Care should be taken to distinguish between these two different conditions; the benignant is free from pain, except when the concretion gets out of place; the malignant is accompanied by constant pain, even when the after-formation rests on the outer circumference of the cavity of the joint. The former bodies are loose, and movable to various parts of the joint; these excrescences, on the contrary, are attached to the surfaces of the joint, whence they grow, and therefore remain in the same place, and are incapable of having their situation altered by pressure or by the motions of the joint. If the former be connected by a fibrous adhesion, or separated by secretion from their base, the motion of both indeed is restricted, but always, though slight, still observable; whilst, on the contrary, the latter never move from their place of origin, and the form of the two sides of their opposite surfaces produces the sensation of their previous junction. Lastly, when examination proves the joint to possess its natural integrity in the former, there is in the latter always more or less change of form, that is, a partial chronic swelling of the joint-ends of the bone, or of the capsular ligament, perceptible.

2278. The operation on the knee-joint is performed in the following manner. The patient being seated on a table in the horizontal posture, the foreign body is pressed to the upper part of the knee-joint, on one or other side, according to ABERNETHY, on the inner, but according to SCHREGER, best on the outer side, towards the condyle of the thigh, and fixed with the fingers of the left hand, so that it cannot escape; if there be several bodies, they must all be fixed in the same way. An assistant now draws the skin as much as possible upwards, and the operator makes with a convex bistoury a vertical cut through the skin and capsular ligament, of sufficient size for the foreign body to be easily pressed out, or removed with forceps. If the foreign body slip away the very moment the cut is made, which I have seen, it must directly be brought back to the cut, but the wound must be at once closed, if this cannot be easily and quickly done. When the foreign body has been removed, the wound must be cleaned, the parallelism between the internal and external wound got rid of, by letting go the skin which had been drawn up, and then closed most carefully with sticking plaster. The limb is to be kept strictly at rest. If no inflammatory symptoms come on, the wound unites in a few days by quick union; but if inflammation should set in, it must be counteracted by active antiphologistic treatment, as leeches and cold applications.

[In the cases in which I have operated, the loose substance was placed most conveniently in the little cleft between the edges of the condyle, and the head of the shinbone, and the margin of the knee-cap; and instead of drawing the skin up, as CHELIUS recommends, I drew it tightly to one side. I do not know, however, that it is of material consequence in which direction the skin is drawn; and the best rule would

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(*a*) Above cited, p. 11.

seem to be, to draw in that direction in which the skin yields most readily, so as to keep the outer and inner wounds farthest apart. This will principally depend on the size and seat of the loose substance, which will also decide whether its removal shall be effected on the inner or outer side of the knee-cap. The operation applies only to the loose cartilaginous or bony bodies, and not to the malignant growths to which Schreger refers, for which amputation is the only remedy.—J. F. S.]

2279. Schreger alone has hitherto removed these bodies from the shoulder-joint. The mode of operation must be directed by the seat of the concretion. The operation would be unsafe if performed in the arm-pit; attempts should therefore be made to press and fix the loose body above and before, or above and without, the short head of the *m. biceps flexor cubiti*. The arm must be pressed to the trunk; an assistant draws the skin as much as possible inwards, and the operator then makes with a convex bistoury a cut through the skin and deltoid muscle, directly upon the body, and in the course of the fibres of that muscle, ties the divided circumflex humeral artery, and having stopped the bleeding, opens the capsular ligament, and removes the foreign body. The treatment of the wound is managed in the same way as in the operation on the knee-joint.

The removal of similar bodies from other joints, as the elbow and the like, is conducted in the same manner.

2280. To diminish the danger in the removal of these foreign bodies from joints, by preventing the entrance of the air, the subcutaneous operation has been proposed, by two stages and at different periods of time (1). The foreign body having been fixed in the above-mentioned manner, a transverse fold of skin is made at the part, through the base of which a narrow bistoury is carried under the skin, and by one or more strokes all the parts covering the body are divided. It is then pressed out of the capsule of the joint into the subcutaneous tissue, where it is fixed with a bandage. Some days after, when the subcutaneous cut is perfectly healed, the foreign body is removed by simply cutting through the skin. Further experience is required to prove whether serious symptoms can always be prevented by this mode of operation, as the cases at present given lead to expect.

(1) Goyrand (*a*) has removed two loose cartilages, one behind the other, from the knee-joint in this way, without any symptoms arising, notwithstanding the unfavourable condition of the patient. Syme (*b*) has also operated successfully in the same way.

XIII.—OF SARCOMATOUS TUMOURS.

(*Sarcomata*, *Tumores sarcomatosi*, Lat.; *Fleischgeschwülste*, Germ.; *Sarcomes*, Fr.)

Abernethy, above cited.

Lawrence, Observations on Tumours; in Med.-Chir. Trans., vol. xvii. 1832.

2281. Sarcomatous tumours have the feel of homogeneous, rather hard, painless swellings, the interior of which present an homogeneous, flesh-like substance, and are developed either as special tumours at one particular part of the body, or by the conversion of any one organ, as for instance, the gland of the breast, the parotid gland, the testicle, and the like, into this particular substance.

[Two kinds of tumours are included in this division, which differ in their nature according to their situation. The first kind, which Chelius notices, are in reality only excessive or hypertrophic growths of the cellular tissue connecting the skin with the underlying parts. and which were well designated by Astley Cooper, as *Cellular Membranous Tumours:* they are generally attached by a neck, have commonly a pear-like shape, are weighty, hang down, and are found on different parts of the body, bu

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(*a*) Gazette Médicale de Paris, vol. ix. p. 329. 1841.

(*b*) Principles of Surgery, p. 231. 8vo. 1842 Third Edition.

not of very frequent occurrence, and sometimes acquire enormous size. Lawrence (*a*) removed one from the buttock of a female, which "had commenced at the posterior part of the left *labium pudendi*, and had extended gradually along the buttock and behind the *os coccygis*." It was twice as large as an adult's head, "its greatest circumference was thirty-two inches, it was twenty-one inches round at the basis, eleven inches from the latter to the middle of its inferior edge, and eight in the line of the basis from the *coccyx* towards the *trochanter*." The root in the *labium* could not be removed, and after some time a fresh growth occurred, and the tumour attained a third of its former size. It was subjected to a second operation, the root followed, and the swelling completely eradicated. I have seen similar tumours, though of less size, two or three times on the *labia pudendi*, which parts seem rather more subject to them than others.

A very remarkable instance of repeated and quick reproduction of one of these tumours, occurred to my colleague Mackmurdo two or three years since. It grew from the under surface of the *urethra* of a woman, and was as large as an orange. It grew again rapidly, and was again removed at the end of a month, having become larger than at first. In five days it had re-formed and was as large as before, then continued growing more slowly; and at the end of three months, having increased considerably beyond the size of the former tumours, was a third time removed, and has not since returned.

Sometimes the neck by which they are attached becomes considerably lengthened: in St. Thomas's Museum, there is an instance in which the neck is about six or eight inches long, and the tumour as big as the fist.

Occasionally, instead of having any neck, the whole cellular tissue of an entire limb may grow enormously; I recollect an instance several years ago, removed by Astley Cooper, in which along the inner margin of each arm, one more so than the other, a long swelling of this kind extended from the middle of the upper arm to the wrist, about two hands' breadth deep, and having the appearance of a hanging sleeve.

Confused with these simple overgrowths of the cellular tissue, are those enlargements of the prepuce and *scrotum*, which correspond to the overgrowths of the prepuce of the *clitoris* and of the *nymphæ*, and depend on slow inflammation with adhesive deposit in the cellular tissue. In the prepuce, this condition in which the cellular tissue is filled with a firm semitransparent jelly-like substance, frequently follows severe external *gonorrhœa*, and can only be got rid of by cutting it off. I have also seen the same conversion of the cellular tissue of the face, in which the eyelids were so completely filled that their apertures were simple transverse slits, and the woman was scarcely able even to see the light. In this case I removed some deep slices (which were semitransparent, tough, and did not ooze out any fluid when squeezed) about a third of an inch in width, at two or three intervals, from below the lower lid, and hoped that the fluid contained in the intercellular spaces would have escaped through the wounds, but it did not, and the wounds healed quickly with but little relief, as at the present time, ten or a dozen years after the operation, her face is nearly in the same condition as at first. The enlargement of the *scrotum* of this kind is a very common occurrence in warm climates, and sometimes becomes very enormous. Titley (*b*) removed successfully the *scrotum* of a negro at St. Christopher's, which weighed seventy pounds. Delpech (*c*) removed the *scrotum* of a native of Perpignan, of which the weight was sixty French pounds; and Liston (*d*) many years ago removed a similar swelling from a young man of twenty-three, which had been growing twelve years, and weighed nearly fifty pounds. In comparison with these the *scrotum* of the French Foreign Minister, Delacroix, which, weighing from twenty-six to twenty-seven pounds, was removed by Imbert de Lonnes (*e*), and at the time made great noise, was trivial.

The second form of Sarcoma, of which Chelius speaks, as attacking organs, is very different from the overgrowth of the cellular tissue, and is the result of inflammatory action, by which the cellular tissue is filled with adhesive matter. In the testicle it is the true or simple *sarcocele*, and is not malignant. It has some resemblance to the enlargement of the *nymphæ* and *scrotum* already referred to, but the deposited matter is more opaque, and so thickly deposited, that the structure of whatever organ it is lodged in, is more or less completely lost, and when cut into has an almost scirrhous appearance.—J. F. S.]

2282. The form of these swellings is various, sometimes they have a neck. In general they grow quickly and attain an enormous size. They

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(*a*) Med. Chir. Trans., vol. xvii. p. 11.

(*b*) Med.-Chir. Trans., vol. vi. p. 73.

(*c*) Clinique Chirurgicale de Montpellier, vol. ii. 1828.

(*d*) Practical Surgery, p. 344. Fourth Edition, 1846.

(*e*) Richerand, Nosographie Chirurgicale, vol. iv. p. 315. Fourth Edition, 1815.

have a doughy feel, and bear even a severe examination without pain. Whilst the tumour is small, the skin covering it has its natural character; but when it has reached a large size, the superficial veins swell considerably, the skin becomes tight, inflames, and ulcerates. This ulceration usually brings about a partial and sometimes total destruction of the swelling, and the effect on the constitution is consequently in general very considerable. During the progress of sarcomatous tumours, various diseased changes may occur in the mass of which they consist.

According to microscopic examination, desmoid, sarcomatous, steatomatous, chondroid and fibroid swellings have been classed together as *fibrous tumours*, as in their perfect state they consist of fibres which interweave them in all directions, or are disposed with a certain degree of regularity, sometimes without any other element, even without vessels, and sometimes only sparingly traversed by vessels. The fibrous structure is not always distinct; in tumours of this kind, still in a state of development, there is often a formless mass, the *blastema* for fibres to be subsequently produced, or blackish cells. (Vogel.)

2283. The cause of these tumours is always previous inflammation, or at least an increased degree of vascular activity, which is produced either by external violence, or dyscrasic affections, especially scrofula and *syphilis*. In consequence of these processes, there is a deposition of plastic exudation, into which vessels shoot, or the nutrition of any one organ is greatly increased, and on the continued deposit of an homogeneous substance, and great development of the vascular system the further growth of the swelling depends.

2284. The *treatment* may, at the commencement of these tumours, prevent their growth by diminishing their unnatural vital activity, or may effect their diminution, by repeated application of leeches, by continued cold bathing, purgatives, compression, and the like. If the swelling become larger, it must be removed by extirpation, or by tying the vascular trunks going to it, or it may be diminished by introducing a seton; under which last treatment it is destroyed partially by suppuration, partially by the inflammation which obliterates its nourishing vessels. Extirpation is managed in the same way as the removal of encysted tumours.

[The removal of these swellings by the knife is infinitely preferable to the introduction of a seton or to tying the nourishing vessels, either of which is very tedious, very tiresome, and the latter often very offensive to the patient from the sloughing which ensues, and very uncertain, as the vessels which afford the principal nutriment may be too deep to be got at.—J. F. S.]

XIV.—OF LARDACEOUS TUMOURS.

(*Steatomata*, Lat.; *Speckgeschwülste*, Germ.; *Stéatomes*, Fr.)

Chopart, Essaies sur les Loupes; in Prix de l'Académie de Chirurgie, vol. iv. p. 274.

Gendrin, Mémoires sur les Caractères anatomiques des Loupes désignés sous le nom de Lipome et de Stéatome; in Journal général de Médecine, 1828, vol. ciii. p. 210.

Chelius, in Heidelb. klin. Annalen, vol. iv. part iv.

Heyfelder, De Steatomate, Commentatio par loco in Senat. Acad. Erlang. ritè obtinend.

2285. *Lardaceous Tumours* are more or less large but firm swellings, consisting of different, but generally globular masses, which contain within them in differently formed spaces, a whitish, tallowlike, more or less firm substance, developed either in the cellular tissue beneath the skin, or the interstitial tissue of an organ.

Boyer (*a*), who, like many other writers, has under the name of *Wens*, (*Loupes*,)

(*a*) Traité des Maladies Chirurgicales, vol. ii. p. 404. Paris, 1822. Third Edition.

classed all circumscribed and painless swellings which are situated in the cellular tissue beneath the skin, and formed of a more or less consistent substance, contained in a proper sac, or in several spaces of the cellular tissue, distinguishes the wens which have a cyst into those formed of degenerated fat, which, deprived of its natural colour, becomes white and hard, is contained in the expanded spaces of the cellular tissue, and mixed with a greater or less quantity of lymph, (*Steatoma,*) and into those, in which the fat retains its natural condition, and only acquires a greater degree of consistence (*Lipoma.*) But the substance of a steatome is not to be considered as merely degenerated fat; it is distinguished, in addition to the difference of substance, by other relations of its internal formation, and especially, as Boyer himself states, from fatty swellings, in that it exclusively possesses the ruinous peculiarity of degenerating into cancer.

2286. The external form of steatome is very various; although round, it still exhibits different projections and irregularities; its greatest extent is in general immediately above its stem, which is commonly thinner, and but rarely broader than the rest of the swelling. The tumour is heavy, does not yield to pressure, consists of several connected hillocky masses, in the interspaces of which there is greater softness and yielding than on its top. The skin covering it is at first natural, movable, especially at its neck, if the tumour be liable to dragging. At the neck of the swelling, oftentimes one or several projecting cords are observed, which spread like roots beneath the skin; and the latter, where corresponding to them, is hard, reddened, and very tense. The growth of a steatome varies; in general it increases slowly, and at first its progress is accompanied with no other inconvenience than that produced by the weight and dragging of the swelling.

2287. As the growth of the tumour proceeds, the skin, earlier or later, reddens on the projecting parts, becomes tense, thinned and adhering. Usually violent stabbing and burning pains attack the whole swelling, and spread into the neighbouring parts. The tumour at last bursts at this part, forms a dirty ulcer, from which a thin stinking ichor is discharged, together with the grayish remains of the steatome. The ulcer spreads, and the same changes attack other parts of the swelling; oftentimes fungous growths spring from the ulcer, and frequent bleedings occur. The root-like cords on the neck of the steatome become harder; the neighbouring glands swell; the cancerous degeneration proceeds in all directions, and the patient sinks under the continued violent pain of hectic consumption.

2288. On examining a steatome, so long as the skin covering it is unaltered, and degeneration has not yet begun, there is found beneath it, a pretty thick layer of perfectly natural fat which penetrates the spaces between the several parts of the swelling. In this fatty mass, there are frequently encysted tumours, connected, however, with the principal swelling. Beneath the layer of fat there is a pretty firm cellular layer immediately investing the tumour. This cellulo-fibrous capsule, which sends some cellular streaks through the layers of fat to the skin, is so firmly attached to the steatome that it cannot be separated without injuring it; it sinks deeply between the several parts of the swelling, and thus forms the single tumours which, connected beneath each other, rise either in a parallel direction, or disposed around the neck of the steatome, separate externally from each other. The lobes of the tumour, when not completely bare of cellular tissue and fat, have considerable firmness, and nearly the resistance of fibro-cartilage; some of the lobes are, however, often soft and elastic. If the swelling be cut through vertically, the formation of the various cells or cavities by the processes of the cellulo-fibrous capsules, which are filled with the substance of the steatome, is perceived. This substance itself is firm, dull white like lard but firmer, and without vessels. At the neck of the steatome, more or less numerous roots are seen penetrating to a certain depth, and exhibiting the same characters as the tumour, that is, surrounded with cellulo-fibrous membrane, which accompanies them to their origin, where is found a layer of very vascular cellular substance, of a dull white colour and fibrous nature, filled in part with steatomatous matter and yellowish fluid, and surrounded with a thick layer of fat. The roots oftentimes do not extend so deeply, and if the swelling be situated in a yielding part, they are, by the weight of the swelling, completely drawn into its neck. The often pretty large vessels penetrate through the midst of the roots into the swelling, and spread in the walls of the smaller tumours; whilst other vessels spread in the fat and skin surrounding the swelling.

2289. When degeneration and softening have already begun in the steatome, larger branches of vessels are observed in the walls of the swelling, and in the yellow spots of the steatomatous substance; at the same time, also, there is an infiltration of turbid, milk-like, and yellow fluid, which can be emptied by pressure. In the further progress of the softening, the substance filling the cells becomes jelly-like, the walls of the cells thicken, and are bluish-white, and the vessels distributed in them are very distinct. The softening is not alike in all the several swellings, and not even in one and the same swelling. When ulceration has began, the walls are tearable and bluish-white, and the substance contained in the cells is nothing but a grayish-white, dirty, semitransparent pap. The fat around the ulcer beneath the skin wastes; there is observed a not deep but distinct scirrhous or brain-like layer; the vascular injection in the cellulo-fatty tissue wastes to the extent of five or six lines, and the fat in equally considerable quantity retains its natural condition, but is mingled with more serosity (*a*).

Heyfelder (*b*), from his microscopical examinations, has proposed four varieties of steatome; *first*, the true fibrous swelling merely consisting of stretched fibres, and of them alone; *second*, those of which the greatest part is made up of the stretched fibres, but present also a cartilaginous and bony structure; they approach the chondroid tumours; *third*, those containing stretched fibres and fat, and are intermediate to *lipoma* and fibrous swellings; and, *fourth*, those which are composed of stretched fibres, cells and *nuclei*, and must be enumerated with malignant tumours (*c*).

2290. Steatomatous tumours are developed often without any known cause, and often in persons whose otherwise good health and appearance lead to no supposition of so considerable ailment of their formative life as is shown in the progress of *steatoma*. Mechanical influences, as blows, pressure and the like, often cause it; though, probably, there is always a previous disposition in the body thereto present. Of the several dyscrasies, the scrofulous seems most frequently to encourage the growth of *steatoma*.

2291. The *treatment* of *steatoma* consists simply and solely in its removal with the knife, and the result of the operation is the more safe according as it is earlier performed, the more complete the removal of all degeneration dependent on the seat and condition of the tumour, and the less the constitution is affected. When already a general reaction upon the whole body appears, when softening and ulceration have set in, there the *prognosis* is always doubtful, because after the operation the swelling frequently is produced anew upon the scar or in some other part (1).

(*a*) Gendrin, above cited.

(*b*) Above cited.

(*c*) Compare the above with the *note* to *par.* 2282.

In conducting the operation, the same rules given for the removal of encysted tumours are applicable, with the special direction, that after the operation, the bottom of the wound is to be very closely examined, for the purpose of removing most carefully every infected part. It is always proper to establish an issue previous to the operation, and to keep it up after the wound has healed; at the same time also, a suitable mode of living and treatment, fitting to the existent general ill condition of the health must be adopted. It is still to be remarked, as a peculiarity of steatomatous tissue, that it heals quickly when injured, in which case numerous granulations form (*a*).

(1) Boyer (*b*) supposes that cancerous degeneration of *steatoma* is so much more to be feared, the larger the quantity of lymph contained in it.

XV.—OF MEDULLARY FUNGUS.

(*Fungus medullaris*, Lat.; *Markschwamm*, Germ.; *Fongus médullaire*, Fr.)

Burns, John, Dissertations on Inflammation, vol. ii. p. 302. Glasgow, 1800. 8vo.

Hey, William, Practical Observations on Surgery, with Cases, chapter vi. London, 1803. First Edition. 8vo.

Freer, George, Observations on Aneurism, and some Diseases of the Arterial System. Birmingham, 1807. 4to.

Abernethy, John, Surgical Works, vol. ii. London.

Wardrop, James, Observations on Fungus hæmatodes, or Soft Cancer, in several of the most important organs of the Human Body. Edinburgh, 1809. 8vo.

Laennec; in Dict. des Sciences Médicales, Article *Encephaloides*, vol. xii. p. 165.

Breschet; in same, Article *Hématode*, vol. xx. p. 126.

Meckee, Handbuch der patholog. Anatomie, vol. ii. part ii. p. 297.

Maunoir, Mémoire sur les Fongus médullaire et hématode. Paris et Genève, 1820. 8vo.

Bartcky, Observatio singularis Fungi medullaris in Corde. Præf. est Dzondi. Halæ, 1821.

von Walther, Ueber Verhärtung, Scirrhus, harten und weichen Krebs, Medullar-Sarkom, Blutschwamm, Teleangiektasie und Aneurysma per anastomosin; in his Journal für Chirurgie und Augenheilkunde, vol. v. parts ii. and iv.

Hasse, Dissertatio de Fungo medullari. Berol., 1824.

Günther, G. B., Diss. Analecta ad Anatomiam Fungi medullaris. Lips., 1824.

Nisle, Beiträge zur Lehre von Blut- und Markschwamm; in Horn's Archiv., 1829, part v. p. 813.

Baring, O., Beobachtungen und Bemerkungen über den Markschwamm; in Holscher's Hannov. Annalen, vol. i. part ii.

Meyen, Untersuchungen über die Natur parasitischer Geschwülste im menschlichen Körper, insbesondere über den Mark- und Blutschwamm. Berlin, 1808.

Travers, Benjamin, Observations on the Local Diseases termed Malignant; in Med.-Chir. Trans., vol. xv. p. 195, 1829.

Walshe, Walter Hayle, M.D., The Nature and Treatment of Cancer. London, 1846. 8vo.

Carswell, Robert, M.D., Illustrations of the Elementary Forms of Disease. London, 1833. fol.

Müller, John, and Vogel, J., above cited.

2292. *Medullary Fungus* (*Soft Cancer* of the older writers, *Spongoid Inflammation*, Burns; *Fungus hæmatodes*, Hey and Wardrop; *Encephaloide*, Laennec; *Hæmatode*, Breschet; *Medullary Sarcoma*, Abernethy; *Medullary Cancer*, Travers; *Cephaloma*, Carswell; *Fungoid Disease*, Astley Cooper; *Encephaloid*, or *Soft Cancer*, Walshe) is an unnatural production, which begins as a little, defined, smooth and

(*a*) Gendrin, above cited.

(*b*) Above cited, p. 345.

even swelling, at first firm, though not hard, and over which the skin is unchanged. As it enlarges the tumour becomes more elastic, and sometimes gives an illusive feel of fluctuation. The skin covering the swelling gradually becomes thinner, adheres to the tumour, and at last bursting, a bloody ichor, escapes; through this hole in the destroyed skin a reddish fungous substance pushes up, continues increasing, and being girt by the round opening of the skin, the edges of which continue thick and unaltered, a longish neck is produced. This fungous growth bleeds on the slightest touch, and by the spontaneous tearing through of the numerous vessels, which pass to its surface, frequent bleedings are caused. Often pieces of the tumour are thrown off, and then exceedingly stinking grayish ichor escapes in large quantity.

[Dr. Thomas Young (*a*) has included under his genus *Carcinoma*, or Cancer, "an uneven tumour, with sharp lancinating pains, tending to ulceration;" two species, "*C. scirrhosum*, Hard Cancer, and *C. spongiosum*, spongy and readily bleeding, Bleeding Cancer" (p. 346); the latter of which is the disease now to be treated of. English writers have, however, generally, with the exception of Travers and Carswell, and more recently Walshe, described and held them as different diseases.

"We may consider," observes Travers, "*Carcinoma* as a genus of the order, 'malignant diseases.' Its species are *first* the scirrhous, *second* the medullary. Their respective modifications and varieties are to be referred to those of structure." (p. 200.)

Carswell says:—"In the genus *Carcinoma* I propose to comprehend those diseases which have been termed scirrhous; common vascular or organized sarcoma; pancreatic, mammary, and medullary sarcoma, and *Fungus hæmatodes.* The following reasons may be assigned for thus grouping together, under the generic term of *Carcinoma*, so many diseases generally described as differing widely from that which is commonly known by this designation:—*First.* They often present, in the early periods of their formation, certain characters common to all of them, however much they may differ from each other in the subsequent periods. *Secondly.* They all terminate in the gradual destruction or transformation of the tissues which they affect. *Third.* They have all a tendency to affect several organs in the same individual. *Fourth.* They all possess, although in various degrees, the same reproductive character. Such are the more remarkable phenomena which, considered anatomically, and in a general point of view these diseases present in common with one another. * * * More in detail. * * * They present differences, some of which are of considerable importance, others much less so. * * * The differences to which I allude, are referable to two states of heterologous deposit, to which the diseases in question owe their origin. The first is that in which this deposit has little or no tendency to become organized. Its form and arrangement appear to be determined chiefly by external circumstances; and its formation and subsequent increase are entirely dependent on the nutritive function of the organ in which it is contained. In the second state this deposit exhibits on the contrary a greater or less tendency to become organized. Although it may, at first, assume a determinate form and arrangement, in consequence of the influence of external circumstances, it possesses in itself properties by means of which its subsequent arrangement and development are affected, independent of the nutritive function of the organ in which it is formed, except in so far as the materials of its growth may be derived from this source. On account, therefore, of these two opposite states of the Heterologous Deposit, *Carcinoma* may be divided into two species, the first of which I shall call *Scirrhoma*, the second *Cephaloma.* * * * In these two species of *carcinoma*, the Heterologous Deposit presents itself under various forms which may be regarded as so many varieties of each species. The varieties of *scirrhoma* are determined chiefly by the relative quantity of the Heterologous Deposit, the manner in which it is distributed, and the difference of colour and consistence which it presents. * * * The principal varieties of *cephaloma* (medullary *fungus*) are derived from the appearances which the heterologous deposit presents, either in different organs or at different stages of its development," as the *common Vascular*, or *Organized Sarcoma*, of Abernethy; his *Mammary Sarcoma* and *Medullary Sarcoma* (the latter being the *Matière Cérébriforme*, or *Encephaloide*, of Laennec; the *Spongoid Inflammation* of Burns; the *Milk-like Tumour* of Dr. Monro; the *Soft Cancer* of

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(*a*) An Introduction to Medical Literature, including a System of Practical Nosology. London, 1823. 8vo. Second Edition.

various authors; the *Pulpy Testicle* of Dr. BAILLIE); and *Fungus hæmatodes* of HEY and WARDROP, which is the *Fungoid Disease* of ASTLEY COOPER.

WALSHE's views in respect to medullary *fungus* and *scirrhus* forming but one genus, are much the same as CARSWELL's, but they differ in regard to *Colloid*, or *Jelly-like Cancer*, which WALSHE holds as a distinct species, whilst CARSWELL considers it merely a variety of his *scirrhoma.* "A single genus of formations represents," says WALSHE, "the subdivision of Infiltrating Growths; this genus is CANCER. It comprehends some important species agreeing in essential characters, both as respects their natural similitude and their dissimilitude to Non-infiltrating Growths. (p. 4.) To our countryman, the late Dr. YOUNG, belongs in reality the merit of having been the first to unite *scirrhus* (*Carcinoma scirrhosum*) and encephaloid, (*Carcinoma spongiosum,*) as species of a genus, cancer or *carcinoma;* but his example has been very slowly followed. English writers, with the exception of Mr. TRAVERS, more keenly perceptive of the differences than of the analogies of these products, have almost to the present day continued to define cancer as ulcerated *scirrhus,* and separate encephaloid completely therefrom, under the titles of medullary *sarcoma, fungus hæmatodes,* fungoid disease, &c. Nevertheless, opinion had been silently undergoing a change among us; we had been gradually learning to recognise the practical truth and importance of Dr. YOUNG's nosological arrangement, when Dr. CARSWELL deprived us of all excuse for wavering by satisfactorily proving its justness. But this is not all; the inquiries of LAENNEC, followed by those of several of his contemporaries and successors, distinctly established the close alliance of another morbid formation, originally described by that acute observer under the title of *tissue,* or *matière colloide,* to *scirrhus* and encephaloid." Differences of opinion have been held as to the relationship of these. "I some few years past ventured," says WALSHE, "to assign to colloid the rank of a species in juxtaposition with *scirrhus* and encephaloid. The additional experience I have since acquired, has still more fully convinced me of the correctness of the views on which this arrangement was founded." (pp. 7, 8.) Hence he divides Cancer, or CARCINOMA, into the three species, ENCEPHALOID, or soft Cancer; SCIRRHUS, or hard Cancer; and COLLOID, or jelly-like Cancer (p. 10.)]

2293. So long as the swelling is small, it usually causes no inconveniences, but with its enlargement becomes more sensitive; sometimes a violent pain shoots through it, and in general when ulceration takes place severe pain is produced. The neighbouring glands swell often to considerable size. Sometimes these glandular swellings occur when the original swelling is still small, and sometimes not, although it be very large; they appear also in parts which have no immediate connexion, by means of the absorbents with the originally diseased part. The fungous structure appears only to be found in the original tumour. In more advanced stages of the disease, the powers are depressed by the often recurring bleedings, and the copious flow of ichor, and at last the patient sinks from the colliquative symptoms. The continuance of the disease is uncertain; it, however, usually proceeds more quickly than cancer.

2294. This disease may occur in every organ of our body; it has been observed in the ball of the eye, on the limbs, in the female breast, on the parotid, on the thyroid gland, on the testicle and the ovary; in the liver, spleen, and kidneys; in the lungs, in the heart, in the mucous bags, and other parts. In these different seats of the disease the symptoms differ more or less, which especially applies to the eye-ball. Of the other cases the development of the disease has especially a nearer connexion in the testicle and in the bones.

2295. *In the testicle,* medullary *fungus* begins either with swelling of the gland itself, or in the *epididymis,* in consequence of which the testicle assumes an oval or rounded form, and it is difficult to distinguish the testicle and *epididymis* from each other. Neither irregularity nor change is observed in the tissue of the testicle; the hardness, however, is at first in general great, but the pain trifling. When the tumour has increased considerably, it becomes softer, and the feel of its containing fluid is exceedingly delusive. In its subsequent course the swelling is at some parts hard, and at other parts very soft, as if it would soon burst. The veins of the *scrotum* swell, and the skin becomes discoloured. The glands of the groin on the affected side, or upon both sides, swell up, and the tumour proceeds along the spermatic cord into the belly. The reaction of this disease upon the general condition of the patient is so great that death may ensue even before the ulceration and protrusion of the *fungus.*

I have seen a case, in which a puncture having been made into a medullary *fungus* of the testicle by another Surgeon, with the object of performing the palliative cure for hydrocele, although the puncture remained open till I subsequently performed castration, and bloody ichor continued flowing, yet no *fungus* appeared.

Upon medullary *fungus* of the testicle, may be consulted—

Gierl, M., Ueber den Fungus, die Struma Testiculi, u. s. w.; in Neue Chiron, vol. i. p. 273.

Cooper, Astley, Observations on the Structure and Diseases of the Testis, p. 116. London, 1830. 4to.

Hertzberg, Ueber Schwamm des Hodens; in von Graefe und von Walther's Journal, vol. xiv. p. 283.

Baring, Ueber Markschwamm des Hodens. Göttingen, 1833.

Curling, Blizard, A Practical Treatise on the Diseases of the Testis, &c., p. 337. London, 1843. 8vo.

2296. All the *bones may be attacked with medullary fungus*, which may originate either between the external surface of the bone and the *periosteum*, or in the interior of the bone (1). In the former case there appears a small, hard, and generally painless tumour beneath the *periosteum*, which softens as it increases, displaces the parts, intereferes with or destroys the functions of the limb to various degrees, becomes painful, and may grow to an enormous size. I have seen two cases in which the swelling occupied the whole thigh-bone, the *periosteum* was raised five or six inches, but the surface of the bone was little changed. The bone is, however, frequently, and especially about the circumference of the swelling, beset with many fine needles or plates, which spring like rays from the surface of the bone, and penetrate into the interior of the swelling. If the *fungus* be developed in the interior of the bone, it not merely fills up its tube, but renders the bony tissue atrophic, so that it is merely surrounded by a thin shell of bone, which is ultimately burst through; such bones, therefore, break on the slightest injury.—(Müller.)

[(1) Medullary *fungus* of bone has been well described by Astley Cooper (*a*), as a species of *exostosis*, under the name, according to its beginning in one or other part of the bone, of *Fungous Exostosis of the Medullary Membrane* and *Fungous periosteal Exostosis.*]

2297. The examination of the tumour after death, or after its removal, presents different results, according to the degree of its development. In the interior there is found a soft substance, which is often scarcely discernibly divided into larger and smaller lobes by fine cellular tissue, homogeneous, milk-white at some parts usually a little reddish, resembling the medullary substance of the brain, and when cut into thin layers, semitransparent. Its consistance is similar to that of the human brain; its tissue, however, is generally little connected, and it easily breaks between the fingers. In proportion as the substance is more or less loosened up, it exhibits more or less resemblance to certain parts of the brain; but most

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(*a*) In his and Travers's Surgical Essays, part i. p. 179, and p. 194. Third Edition. 1818.

commonly it has the nearest resemblance to the somewhat softened brain of a child. On the surface of this substance run a quantity of blood-vessels, the trunks of which spread upon the surface and in the depressions of the swelling, and the branches penetrate into its substance. If the tumour be examined in an advanced state, when it has already attained a tolerable size, its substance has a very different appearance at different parts. It sometimes resembles pus, and is of a whitish or reddish-white colour; in consequence of the outpouring of blood and a greater development of the vessels, certain parts have often a dusky-red colour, and appear like lumps of clotted blood. Sometimes the substance is so mixed with blood that it has no longer any resemblance to brain, but has a reddish, blackish colour, and has the consistence of partially-dried and tearable dough. Some pieces are often dusky yellow, and resemble yolk of egg in consistence and colour. In general, however, certain parts still retain their brain-like character. Some firm cartilaginous, and even bony spots, are often observed in the substance; and the latter is especially noticed when the disease occurs in the eyeball.

The chemical examination of of the brain-like substance shews that it consists of *albumen*, fatty matter, osmazome, lime, magnesia, phosphate of potash, sulphur, and phosphorus, and consequently, as regards its elementary parts, it is similar to the substance of the brain.—(MAUNOIR, BARTCKY.) According to BRANDE's (*a*) statement, the principal element of medullary *fungus* is a peculiar fibrous matter, partly insoluble in acetic acid. The fat which the *fungus* contains, cannot be converted into soap, and contains phosphorus, like the fat of the brain.

[The following is the analysis of the brain-like substance of medullary *fungus* given by FOY (*b*):—

Albumen	47,00	Subphosphate of lime	6,30
White fatty matter	7,50	Carbonates of soda	2,75
Red fatty matter	5,35	lime	4,00
Osmazome	4,00	magnesia	1,00
Fibrin	6,50	Hydrochlorates of potassa	2,70
Water	8,00	soda	2,00
Oxide of iron	1,35	Tartrate of soda	0,35

According to HECHT (*c*), gelatin is found in this substance, though less in quantity than in *scirrhus*; but its proportions vary in different stages of medullary *fungus*, the gelatin being in greater quantity than the *albumen* in the first, or stage of *crudity*; whilst it was found considerably less than the *albumen* in the second, or stage of *softening*. MAUNOIR, however, ascertained that no gelatin existed in the brain-like mass; and his statement is confirmed by MÜLLER, who on this account, places medullary *fungus* among tumours which are albuminous and do not contain gelatin: though he says, "in one case of medullary *fungus*, he obtained, after boiling it for eighteen hours, a little gelatin, whilst the principal part showed no disposition to be changed or dissolved. The exceptional appearance of the gelatin he attributed to the addition of some cellular tissue."—(p. 5.)]

KRAUSE (*d*) found in the medullary matter, in addition to an unnaturally loose or formless whitish substance and branching vessels, a quantity of round and oval corpuscles, $\frac{1}{225}$th of a line in diameter, opaque-white, transparent at their edge, uneven, resembling pus-globules, and also, smaller, smooth, clear globules, from $\frac{1}{2250}$th to $\frac{1}{830}$th of a line in diameter.

GLUGE (*e*) considers medullary *fungus* as no peculiar tissue, but merely an infiltration of a diseased fluid into the healthy tissue, as into a sponge, by which it is distended and altered into the most various forms. The white fluid squeezed out presents, when magnified two hundred and fifty-five times, numerous corpuscles, with a small quantity of large, irregular particles, in a transparent fluid. These corpuscles are spherical, but their upper surface is streaked, and these dusky streaks stretch to the edge. They have

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(*a*) See BARING; in HOLSCHER's Annalen, above cited.

(*b*) Archives Générales de Médecine, vol. xvii. p. 185. 1828.

(*c*) LOBSTEIN, Traité d'Anatomie Pathologique, vol. i. p. 456. Paris, 1829. 8vo.

(*d*) Above cited.

(*e*) Anatomisch - mikroscopische Untersuchungen zur allgem. und speciell Pathologie, part i.–ix. Leipzig, 1839.

nowhere spots like pus-globules, and are much larger, being $\frac{1}{75}$th of a millimètre in diameter, whilst the pus-globules are only $\frac{1}{100}$th. About two-thirds of the medullary substances are made up of these corpuscles. When the *fungus* becomes larger, there are still distinguished a quantity of large irregular particles, which all have dusky and pale lines; perhaps here, instead of corpuscles, only irregular bodies and fibrous matter have been capable of being formed, differing according to the organ affected. The greater the quantity of medullary corpuscles and medullary substance deposited in the *fungus*, the greater is its softness, even to fluidity; and then occurs the illusive feel of fluctuation, which can only be distinguished from that of pus, in that the collections of the latter are isolated, whilst the medullary corpuscles are infiltrated between the several primitive fibres. If, however, but little medullary fluid be deposited, the tissue retains its ordinary hardness and consistence. A very remarkable circumstance is the presence of medullary corpuscles in the entire substance of an organ, where only some small *fungi*, or even none at all, exist, whilst they are present in other parts of the same individual. The medullary substance operates destructively, just like gangrene, upon the tissue in which it is collected, if it have affected it long enough. The fibres of the organ retain their usual direction, but in small *fungi* are separated by close-lying particles, and when more advanced, fibres can no longer be traced. In all these forms of *fungus*, there are numerous rhomboidal crystals of $\frac{12}{700}$ths of a millimètre, mean diameter, commonly in groups, but in quite fresh *fungus* they are scattered, on which account they must be sought for.

In the development of inflammation, the whole swelling, or part of it, distended with blood, presents newly-developed thick nets of capillary vessels, and the medullary corpuscles are mixed with compound corpuscles. Fibrous matter may also be closely deposited in the *fungus*, and so give it the appearance of a scirrhous degeneration. Concentrated sulphuric acid dissolves the medullary corpuscles in part, and there remain only little dusky bodies; in like manner hydrochloric acid exhibits a flocky, granular substance. Alcohol coagulates the medullary fluid, and the medullary corpuscles, like those of pus, become still more distinct, without changing their shape. Acetic acid dissolves the medullary corpuscles but very slowly, which is done much more quickly in pus-corpuscles. The crystals dissolve in sulphuric so completely as to leave a sediment; whilst in nitric and hydrochloric acid, on the contrary, they do not dissolve at all.

The medullary substance exists also in the fluids of the human body. GLUGE observed in one case, in the blood-clot of the right iliac vein, an undoubted medullary mass; the walls of the vein were healthy, and led to no diseased organ.

2298. The tumour presses the neighbouring parts together, the muscles are often completely enclosed in the substance, and as it were marbled with it. The whole mass is surrounded with a cellular investment, more or less distinct, according as it is developed in an organ, of which the cellular tissue is of a tougher or more yielding nature. The external form is in these cases generally round, sometimes flattened, egg-shaped, sometimes quite irregular, and its external surface divided into lobes, which are separated by more or less deep furrows. LAENNEC, as also CRUVELHIER, found the brain-like substance contained in cysts, of which the walls were pretty even, scarcely more than half a line thick, of a grayish white, silvery or milk-white colour, and semi-transparent, in their structure resembling cartilage, and so firmly connected with the brain-like mass, that they could not be easily separated.

2299. In *medullary Fungus of the Testicle*, the brain-like substance has generally a pale-brownish or reddish colour; oftentimes the whole testicle is converted into a mass of this kind. Often this mass consists of many parts, very different from each other in reference to their tissue, and separated by thin membranous partitions from each other: some portions are soft, others hard, and some actually bony. If this substance be rinced in water, a soft cellular tissue remains. The partitions are generally united to the *tunica albuginea;* but sometimes they are separate, and the interspace is filled with water. In the bones, the swelling most commonly has a white brain-like nature; all the above-mentioned varieties, however, occur. Bone and *periosteum* are as above mentioned. (*par.* 2296.)

2300. The following are the characters of medullary *fungus*. The swelling is soft, elastic, and both during life and after death, yields a delusive fluctuation to the touch; destruction at one part of the skin covering it, through which sprouts a *fungus*, loose, but little painful when touched, and bleeding readily; the edges of the skin encircling the neck of the swelling often remain a long while in their natural condition, without thinning, or undergoing any other change; neither do the considerable discharge of ichor nor the throwing off of portions of the fungous growth produce any diminution; on the contrary, the swelling continues increasing, and thrusts the surrounding parts asunder, without infecting them with its own peculiar diseased metamorphosis; they are only altered by the continued pressing together which the swelling effects upon them. This disease especially occurs in the earlier periods of life.

2301. The diseased substance contained in the tumour differs so much at different periods of the disease, that a definition which shall include all stages of its development is impossible. It may be whitish, reddish, brownish, and even black; its consistence may vary equally, which depends on more or less of the cruoric or albuminous elements of the blood being deposited. On these different relations of the diseased substance rest the conditions, which have been put forward as different degenerations, and bear different designations, though alone depending on the different stages of its development, or on the peculiarity of the organ in which it has its seat.

Of the many designations applied to this disease, all of which are taken from different stages of its development, I have preferred *Medullary Fungus* (*Markschwamm*) as most appropriate, and specially as thereby all confusion with the blood-*fungus*, produced by unnatural distension of the capillary-vascular system, (*par.* 1507,) is avoided.

Allan Burns (*a*) makes a difference between *fungus hæmatodes* and *sarcoma medullare*, in that, in the former, the substance of the swelling is penetrated by a quantity of membranous bands, whilst in the latter it is of an homogeneous medullary consistence, and similar to the cortical substance of the brain. In the former, if the soft brain-like mass be washed away, the membranous partitions still remain; but if the latter be treated in like manner, its capsule only, and a number of *flocculi* hanging from its inner surface, are left. I have never found these distinctions in my examinations.

von Walther has also founded a difference between *fungus hæmatodes* and *sarcoma medullare*, on the difference of the substances composing the swelling, from which he assumes, that though in other respects the nature of both tumours is alike, and the substance of both alike consists of cellular tissue and vessels, some of which are lengthened, and some newly produced, yet that the blood is deposited rather in its cruoric elements in *fungus hæmatodes*, and in its white, albuminous elements, in *sarcoma medullare*. I have really found such different relations of these substances to each other, that in the otherwise like progress of both diseases, it is difficult to determine such distinction.

According to Samuel Cooper (*b*), Abernethy did not assume the identity of *sarcoma medullare* and *fungus hæmatodes*, as has been done by Wardrop and others.

[Abernethy certainly does not assert the identity of medullary *sarcoma* and *fungus hæmatodes*: for, in considering the former, he does not make the least allusion to the latter, although the two cases he gives in illustration are both medullary *fungus*, one of which had burst and bled before death, and in the other the patient died before the skin ulcerated. But he does incidentally refer to Hey's *fungus hæmatodes* in relating the case of a girl who had a cyst on her arm, which he punctured, and discharged a little *serum*, but on introducing the finger, some strata of coagulated blood came away, and severe bleeding ensued, which could not be stopped, and the arm

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(*a*) Surgical Anatomy of the Head and Neck, p. 220.

(*b*) First Lines of Surgery, p. 358. Seventh Edition.

was obliged to be amputated; in doing which, however, part of the cyst was left behind, which thrust forth a *fungus*, and the girl died. ABERNETHY remarks:—"An unrestrainable hæmorrhagic tendency seems to be the essential character of that disease, which Mr. HEY has denominated *Hæmatodes*. That it takes place from diseased structures is manifest; yet I have known it happen without any morbid growth having preceded it." He then observes, that "the term *fungus hæmatodes* seems to be a name commonly now applied to every bleeding *fungus*, whilst that hæmatodal disposition, which Mr. HEY has described, is very rare;" and concludes by giving a case exemplifying HEY's views, which is evidently a case of medullary *fungus*, in which, according to WALTHER's opinion, the cruoric part of the blood was that deposited forming *fungus hæmatodes*. (p. 125–27.) ABERNETHY had either a very confused notion of these two forms of the same disease, or, like many other authors, did not like to disturb or intercalate the classification of tumours which he had made.—J. F. S.]

The most decided difference between the two diseases is, that in *sarcoma medullare* after the part has broken, the place heals till another similar tumour bursts through the skin; whilst on the contrary in *fungus hæmatodes*, the *fungus* grows larger and larger, never diminishes by being thrown off, nor is there ever any attempt at a curative process. I have frequently noticed this distinction in the progress of the disease, but have not been able to determine how far it has been actual or only accidental, according to the difference of the organ affected; as for example, in the testicle there is scarcely ever protrusion of the fungous growth.

JOHN MÜLLER (*a*), who views medullary *fungus* as merely a modification of Cancer, (*soft Cancer*,) considers it most correct to employ the name *medullary fungus*, as a collective designation of the different forms of soft cancer which run into each other, and hence from his own observation he enumerates the following:—First, *Carcinoma medullare*, with formation of medullary substance composed of roundish formative corpuscles in greater quantity than the delicate fibrous tissue, which runs through the tumour. These are the corpuscles seen by GLUGE (*par.* 2297); they are those of common cancer, and very like the gray basal substance of *Carcinoma reticulatum*. Second, *Carcinoma medullare*, consisting of oval, tailless corpuscles, in addition to an extremely soft, brain-like substance. Under the microscope these corpuscles are one and a half as large as the blood corpuscles, and of like breadth. Third, *Carcinoma medullare*, with tailed or spindle-shaped corpuscles. Such medullary *fungi* have sometimes, when broken, a sort of fibrous appearance, if the tailed corpuscles be regularly disposed. They are sometimes scattered among other formative corpuscles, sometimes exceed them in number. According to the direction in which the corpuscles are disposed in reference to each other is there, sometimes the appearance of a radiated formation, sometimes of a clustered arrangement; but at other times their direction is so various, that the swelling when broken exhibits no fibres. In other respects there is no criterion of the malignity of a tumour in the tailed corpuscles, as there are many benignant, albuminous *sarcomata* with tailed corpuscles, and many fibrous tissues in the embryon consist of tailed corpuscles.

According to VOGEL, the essential element of medullary *fungus* in the different parts of the body is *a cell*, doubtless developed from a formless *blastema*, which escapes observation. The cells have very different forms and size, oval, roundish tailed, sometimes very largely branching, like the pigment-cells of the *lamina fusca*. Almost all these cells present a *nucleus* with or without a nuclear body. Many cells contain very numerous cell-*nuclei*; not unfrequently large cells are observed which contain one or more little ones (*mother cells with daughter cells*.) The cell-*nuclei* seem first to arise from the cells. Very frequently there are *nuclei* without investing cells, some single, some collected in packets; but very rarely are the cells devoid of *nuclei*. The cells of one and the same medullary *fungus* ordinarily present the same or a similar character. Sometimes the cells, free from all foreign parts, without any visible connecting medium, are closely locked together and form the whole tumour. In other cases, there is a fibrous basal tissue (*stroma*) between the cells, and when this is in excess, the medullary *fungus* runs into *scirrhus*. When complicated with *melanosis*, the cells filled with black pigment plunge among the medullary *fungus* cells. If they be fewer in number and equally distributed, the medullary *fungus* appears gray throughout; if only disposed in certain parts, it is marbled and veined. When *melanosis* is prevalent, the swelling is black.

In regard to the so-called *blood-fungus*, the opinions of BRADLEY and JAEGER remain to be mentioned.

BRADLEY (*a*) supposes that *fungus medullaris* is nothing but the distension of a vein

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(*a*) Above cited, p. 21.

(*aneurysme veneux.*) At first, whilst the blood in the aneurysmal sac is still fluid, opening the tumour and obliteration of the vessel suffice for the cure; in this case, the aneurysmal sac is still healthy. But if the blood be clotted, the sac becomes diseased and liable to form a *fungus hæmatodes.* ELSE observed a *fungus* communicating with a vein. POTT's Aneurysm?

JAEGER (*b*) holds that blood-*fungus* consists of larger or smaller, thin and thick skinned cells, penetrated with delicate streams of blood or actual vessels, and possessing a more or less distinct mucous membrane. In these cells is contained blood, some of which is clotted, some thinly fluid, and some decomposed. Several cells are generally torn, and the whole swelling often consists of an homogeneous mass of blood. This tumour either lies loose in the cellular tissue, or is surrounded with a tough, fibrous, very vascular cyst, in the covering of which, the cellular tissue is also very vascular. No trace of lard-like or brain-like substance is discoverable. Between some of the cells, fibrous ridges are sometimes found. Single vessels and their openings into the cells, are not to be discovered.

VOGEL considers blood-*fungus* as merely a complication of medullary *fungus* with teleangiectasy.

2302. As in *scirrhus*, the tissue forming the swelling exhibits great variety, depending on the different proportions of the fibrous and lard-like substance, so that in this respect, two extremes may be pointed out, of which, the one presents a fibrous centre, whence proceed numerous fibrous rays, between which but little lard-like substance is scattered, whilst the other exhibits an homogeneous lard-like substance, without a trace of any such fibrous rays; so a like relation is also noticed in medullary *fungus*. A pure white, brain and marrow-like substance here and there mixed with a brownish or blackish substance and clotted blood, and at the other extreme, only a brownish or blackish mass of blood, and that condition which JAEGER has pointed out as blood-*fungus*.

2303. MECKEL holds, that the swellings called by LAENNEC, and others, *Melanosis* are completely the same as medullary *fungus;* and in one respect, he is certainly right, because the substance forming medullary *fungus* in many cases is, for the most part, blackish, and seems to resemble a black pap. But *melanosis* occurs in other ways, and is to be considered merely as a diseased secretion of a colouring matter, a pigment, the analogue of which is also found in a healthy state of the body, and deposited in the *parenchyma* of the organ on different surfaces, even on mucous membranes, as I myself have observed in the nose. If then *melanosis* be no degeneration, no product of a new structure, but merely an altered secretion, therefore also does the black substance present no trace of organization, and may be observed alone, or in tumours of different kinds. This unnatural secretion depends on difference of temperament and constitution, on peculiar changes of the blood in diseases of the kidneys, lungs, skin, and the like, whereby the throwing off of the phlogiston is prevented, and an increased production of carbon caused. The symptoms noticed in *melanosis*, seem rather to arise from other circumstances which exist with that disease, than from the disease itself; for instance, from chronic inflammation, from the simultaneous presence of unnatural formations, as medullary *fungus*, cancer, tubercles, or from the mechanical irritation and pressure of the deposited substance.

According to this variety in the occurrence of *melanosis* are its different course, and influence upon the constitution, as also the different results which are apparent from microscopic observation. It sometimes exists for a long time without any effect upon the health; sometimes the powers

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(*a*) Dict. des Sciences Médicales, article *Hématode*, vol. xx. p. 133.

(*b*) SCHAFFNER, F. A., Ueber den wahren Blutschwamm, eine inaugural Abhandl. Würzb., 1834.

soon sink; sometimes it continues till the *melanosis* runs on to an open ulcer; then from the clefts and fissures of the broken-up swelling, escapes a black fluid, and mixed with pus when the neighbouring parts have been destroyed. These openings sometimes heal, sometimes break out again, and run on to destructive sloughing and the like.

Upon the subject of *Melanosis*, the following writers may be consulted:—

Bayle, Recherches sur la Phthisie pulmonaire, Obs. xx. xxi. Paris, 1810.

Laennec; in Journal de Médecine, par Corvisart, &c., vol. ix. p. 308.

Mérat; in Dict. des Sciences Médicales, Article *Melanose*, vol. xxxii. p. 183. 1819.

Cazenave; in Dict. de Médec., Article *Melanose*, vol. xix. p. 324. 1839.

Breschet, Considérations sur une altération organique appelée Dégénération noire, Melanose, Cancer melane, etc. Paris, 1821.

Heusinger, C. F., Untersuchungen über die anomalen Kohlen-und Pigment-Bildung. Eisenach, 1823.

von Walther, above cited, p. 567.

Noack, C. A., De Melanose cum in hominibus tum in equis obveniente. Lips.; with three copper plates.

Cullen, Will., and Carswell, R., M.D., On Melanosis; in Medico-Chirurg. Trans. of Edinburgh, vol. i. p. 264. 1821.

Fawdington, Thomas, A Case of Melanosis, with general Observations on the Pathology of this interesting disease. London, 1826; with a plate.

Schilling, E., Dissert. de Melanosi. fol. Francof., 1831.

Carswell, Robert, M.D., Illustrations of the Elementary Forms of Disease, fasc. iv. Melanoma. London, 1834.

Vogel, above cited.

2304. If the above-mentioned appearances of medullary *fungus* be compared with the internal condition of *scirrhus*, the following distinguishing characters may be observed. The tissue of *scirrhus*, which must not be confounded with induration, equally at its onset forms a hard, firm, incompressible substance, which when cut into thin layers, is semi-transparent, has the consistence of cartilage and fibro-cartilage, even to that of lard, with which it agrees in appearance, and is composed of two different substances; the one hard and fibrous, the other soft, and of an inorganic appearance. The fibrous part forms various partitions and cavities without arrangement, in which is contained the softer substance, ordinarily of a pale brownish, sometimes bluish, greenish, whitish or reddish colour, similar to hardened *albumen:* the fibrous part has sometimes a cartilaginous hardness. But especially are the proportions of these substances very different. Sometimes the fibrous substance forms the *nucleus*, from which the partitions spread in every direction, and, when cut through, presents a radiated appearance. Oftentimes the swelling has an uniform hardness, in which no distinct tissue can be traced. Sometimes encysted tumours form in the *scirrhus*, filled with differently coloured fluids. Ulceration always begins in these swellings with excessively severe stabbing, lancinating, burning pain, extending either from without inwards, or from within outwards, and accompanied with secretion of acrid, very stinking ichor. Sometimes a bleeding hard *fungus* springs from the surface of the ulcer. This, however, is not always the case, and in the further progress of the disease, this *fungus*, together with everything that surrounds it, without distinction of tissue, is destroyed, after having previously passed into a scirrhous state. Cancer is the especial peculiarity of advanced age, and most commonly occurs at the critical periods of life, when the capability of production declines. It may otherwise be primarily developed from any *scirrhus*, or from any ulcer, if its bottom have passed into a scirrhous condition.

A resemblance between medullary *fungus* and cancer can alone be drawn from the following circumstances: in both diseases, when ulceration has taken place, a thin, filthy-smelling ichor is secreted; in cancer there are often fungous growths; both are in a high degree destructive, spread in all directions, are frequently accompanied with bleeding, commonly appear in different organs in the same individual, at the same time, and rarely heal. But in medullary *fungus* it is always characteristic that it spread only by growth, and compress the parts, but not as cancer, which, by its extension, draws the parts into the same degeneration. I cannot therefore, in this respect, agree with John Müller (*a*), when he states that medullary *fungus* with tailed corpuscles can be distinguished from the benignant corresponding *sarcoma*, for this only admits the distinction of the tissue formation in the affected organs or their neighbourhood.

Breschet (*b*), who, like most French writers, applies the term *Carcinoma* to a different degeneration from *scirrhus* and cancer, points out four different kinds; first, *Carcinome encephaloide ou cérébriforme;* second, *Carcinome melané;* third, *Carcinome fongoide;* and fourth, *Carcinome hématode.* If the description be compared with the results which I have given from examination of medullary *fungus* in its several stages, it cannot be otherwise considered than that these kinds of *carcinoma* are merely different degrees of development of medullary *fungus;* nor to think that it is contrary to the usual mode of expression, to point out with *carcinoma* another state of disease, than the passage of *scirrhus* by ulceration into open cancer.

Meckel (*c*) holds that Abernethy's *sarcoma tuberculatum* probably agrees entirely with medullary *fungus.* As this opinion is not supported by any positive grounds drawn from *sarcoma tuberculatum*, so I think I can the less agree with it, as the symptoms which set in with that disease do not accord with those given to medullary *fungus. Sarcoma tuberculatum*, according to Abernethy (*d*), consists of an agglomeration of firm roundish tumours of different size and colour, connected together by cellular substance. Their size varies from that of a pea to that of a horse bean and above; their colour is brownish red, and in many yellowish. Abernethy had seen the disease only in the lymphatic glands of the neck. It runs on to ulceration, malignant, phagedenic sores, and thus causes death. From this description *sarcoma tuberculatum* does not in the least agree with medullary *fungus*, and it seems rather that it must be taken for a cancerous degeneration, at least when it has passed into ulceration and incurable sores.

2305. In regard to the ætiology of medullary *fungus*, nothing decisive is known. In most cases the disease is developed without any perceptible remote cause, and it is usually found not confined to one spot, but present at the same time in several organs. Under such circumstances the whole constitution ordinarily exhibits general disease; the skin is of a greenish-yellow colour, frequently covered with a clammy sweat, there is constant troublesome cough, difficulty of breathing, and the like. If no decided general affection can be perceived, still there is a peculiar *diathesis* not to be mistaken, which is best distinguished as the *diathesis fungosa.* Sometimes an external mechanical influence is the cause of this disease, and although it be quickly developed under these circumstances, yet is its influence upon the constitution less. It is quite undecided what general affections, scrofula, rheumatism, gout, *syphilis*, and the like, contribute to the origin of this disease.

According to my observations medullary *fungus* may be developed in every organ. Its seat is in the cellular tissue, in which the capillary vessels and vegetative nerves are spread. In the cellular tissue, where the vessels are numerous, new vessels are formed, the tissue itself loosens

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(*a*) Above cited, p. 27.
(*b*) Above cited.
(*c*) Above cited, p. 297.
(*d*) Above cited, p. 51.

up, effusion takes place, which, according as the albuminous or cruoric part of the blood prevails, exhibits, in various proportions, the white, brain-like, gray, or reddish, brownish, even blackish colour, or all these together.

2306. Art can do little against medullary *fungus*. The strongest escharotics are unable to restrict its growth. The only remedy which discovers the possibility of cure is the early, complete removal of the part, or the amputation of the limb on which it is seated, and the employment of such remedies as may improve the constitution. This practice, however, is but in the rarest cases crowned with success, as the disease either recurs in its original seat or in some other organ, and makes quick progress. The time when it reappears is various; sometimes the fungous mass quickly shoots forth from the operation wound; sometimes during the first stage of scarring; at other times after the wound has been some time healed.

XVI.—OF POLYPS.

(*Polypi*, Lat.; *Polypen*, Germ.; *Polypes*, Fr.)

2307. Polyps are unnatural growths arising from the surface of mucous membranes, and in reference to their nature, form, size, and mode of production, very different from each other. They are commonly divided into *Soft Polyps* (*Schleim-Blasen-Polypen*, Germ.; *Polypes mous*, *vésiculeux ou muqueuses*, Fr.) and *Hard Polyps* (*Fleisch-Polypen*, *fibröse Polypen*, Germ.; *Polypes durs*, *charnus ou fibreux*, Fr.)

2308. The *Soft Polyp* consists of an homogeneous soft tissue, containing in its cells a mucous fluid which escapes when squeezed, and thus may be very much diminished in size, leaving only a slimy skin remaining. Its surface is covered with a very thin process of the mucous membrane lining the cavity in which it is developed, and so intimately connected with the polyp itself as not to be separable from it; some minute vessels and nerves are spread upon its surface, but very few of either are found in its interior: its colour is grayish white, or yellowish; it is commonly attached by a stem; its form varies and depends on that of the cavity in which it is developed; it in general grows quickly, enlarges in a moist, and diminishes in a dry atmosphere. Usually several of them exist at the same time, but cause no other inconvenience than blocking up the canal in which they have been formed.

2309. The *Hard Polyps* have a more or less red or bluish appearance according to the quantity of blood-vessels branching in them, and are covered with a shining skin, which is tolerably firm. The arteries always run in the middle of the stem and of the polyp itself, whilst the veins are superficial. Their surface is either smooth or furrowed, and cleft, which doubtless depends on the rending of the enclosing skin. Their interior consists sometimes of an homogeneous, fleshlike, very vascular substance, in which case it is called a *Fleshy Polyp* (*Fleisch-Polyp*, Germ.); sometimes of a very thick cellular tissue divided into lobes by fibrous bands, and hence it is named a *Fibrous Polyp* (*fibröse Polyp*, Germ.) The base of the polyp is usually narrow, and its form bean-shaped; sometimes it is attached at a single point, and sometimes has several roots, and these are not always superficially connected with the mucous membrane, but often penetrate deeply into its substance. These polyps grow slowly, their form depends little on that of the cavity in which they are contained, the bony walls of which they often burst asunder by their pressure, in consequence of which, the polyp itself is often torn, ulcerates and adheres at different points. In consequence of the strangulation which the polyp undergoes, the blood collects in it, and it becomes bluish; by the tearing of the vessels considerable bleeding ensues; it sometimes inflames, ulcerates, becomes gangrenous, and throws off its lobes; sometimes it is painful, at other times not so.

2310. This division of polyps does not indicate all the differences which they present. Oftentimes the polyp remains in the same state a long while, and is restricted to the same size; sometimes it grows quickly; but at other times this only happens in consequence of some accidental irritation. In consequence of such irritation, various changes are set up in its tissue, and may run on to scirrhous degeneration. There is then considerable hardness, the tissue becomes lard-like; severe lancinating pains occur; a stinking ichorous fluid continually flows from it; it bleeds on the slightest touch, and grows excessively quick. The degeneration of a polyp into cartilage, has been, although rarely, observed. In other respects, the tissue of one and the same polyp is every where the same.

2311. The symptoms specially produced by polyps are different according to their nature, size, and seat. At first the polyp is painless, and the annoyances from it depend on the pressure which the walls of the cavity and the neighbouring parts suffer from it; as it enlarges both the hard and soft parts by which it is surrounded are burst asunder, the bones thin, become fragile, and at some parts are, as well as the soft parts, completely destroyed. If the polyp be painful, it appears to be the result of incipient degeneration. The then always increasing, continual pain, the frequent bleedings, and the destruction of the neighbouring parts, lead on to death from exhaustion, or it results from the pressure made upon important parts. The harder the polyp, the more is cancerous degeneration to be feared. Soft are much less dangerous than hard polyps, and so long as they retain their cellular structure, no inflammation or degeneration readily takes place in them.

I have frequently noticed medullary *fungus* of mucous membranes, in form of grayish-white, or reddish excrescences, without any symptom indicating the great danger of that disease. After removal, the excresences soon came again, and caused death, by the destruction of the neighbouring parts, in consequence of their unrestrainable enlargement.

2312. The *proximate cause* of polyps is an alteration of the vegetative processes depending on continued irritation of the mucous membrane, producing these new and peculiar formations, which are either developed from the *parenchyma*, or from the deeper tissues which the mucous membrane overspreads, and are thereby distinguished from the mere swelling up of the mucous membrane, which has the same tissue as the membrane, whilst in polyps there is nothing resembling it. In mucous polyps, the unnatural formation is confined simply to the mucous *parenchyma* of the mucous membrane, from which any participation of the vessels is wholly cut off; they are therefore without any vascular apparatus, and are to be considered merely as processes and dependencies of the unnaturally vegetating *parenchyma*, overspread with *epidermis*, the tissue of which, when there is also irregular enlargement of the vessels of the mucous membrane, (angiectasic complication,) are drenched with transuding blood, or in addition to this, with mucous juices, which, however, are only inorganically changed.

But in fleshy polyps, with the unnatural growth of the *parenchyma*, there is also an arterial vascular system, they live as self-reproducing substances, in which an organic circulation can be observed, and the cellular substance is converted rather into a fibrous texture (*a*). From this circumstance the blood-vessels in polyps are sometimes found very numerous, often in very small quantity, and at other times entirely wanting. Therefore, the opinion held by some may be correct, to wit, that polyps have no vessels, but merely possess blood canals in their tissue, which are not like blood-vessels ordinarily separated from the surrounding parts (*b*).

Polyps are formed in all ages, in either sex, in every constitution; they are most frequent in adults, but rarer in very old persons.

The occasional causes are dyscrasies, especially scrofula, *syphilis*, and continued irritation of the mucous membrane by external influences, producing a condition which is kept up by irritation, and give another tone to the vegetative process of the mucous membrane. In this latter circumstance, is probably the reason that polyps are most commonly seated at a little distance from the passage of the skin into mucous membrane, and that they frequently occur in the womb.

In many instances the ætiology of polyps is quite obscure.

2313. The *prognosis* is guided by the nature, form, and seat of the polyp. Mucous polyps are in general more easily cured than those which are hard; the harder a polyp is, the more is cancerous degeneration to be dreaded, which when once set in, no cure can be effected. The broader the base of the polyp, the more difficult; and the more it is necked, the easier is its removal. Such is also the case when the polyp is developed near the outlet of a cavity, and when the proportionate size of the latter to the former does not interfere with the employment of the necessary instruments. The more completely a polyp is removed, the more certain is the cure; if bits of it remain, it is developed afresh; nevertheless, even after its complete removal, a recurrence is not infrequent.

2314. The *cure* of polyps is effected by tearing, or by cutting them off, by tying them, and by destroying them with the actual cautery, or other escharotics. The choice of these several remedies must be directed by the individual case.

The drying used in former times, the tearing to pieces, (Paulus Ægineta, Albucasis,) torsion, (Brodon,) the squeezing to pieces, and pulling away piecemeal of polyps are now but matters of history.

2315. *Tearing out polyps* is performed with the polyp-forceps, which, when the seat of the polyp is well ascertained, are carried to its root, the polyp grasped with them, and separated by a twisting rather than a drawing motion. This method is simple and quick; it is usually followed only by slight reaction from the injury done, the neighbouring parts are neither damaged, nor disturbed in their functions; recurrence of the disease is less frequent after this than after other methods. But tearing out is not applicable if the polyp have a broad base, if it be attached to yielding parts, if it be very deep seated, and if difficulty in stopping bleeding be feared.

2316. *Cutting off the polyp*, which some of the moderns endeavour to bring into general practice, is only applicable where the disease is not deep-seated, and the introduction of the instruments necessary for the operation can be effected without injury of the neighbouring parts; also

(*a*) Schreger, Annalen des Chirurgischen Clinicums außer Universitat zu Erlangen, p. 47. Erlangen, 1817.

(*b*) Meissner, Ueber die Polypen in den verschiedenen Höhlen des menschlichen Körpers, p. 13. Leipzig, 1820.

when the seat of the polyp admits the use of remedies to stanch the bleeding, which is always to be feared in cutting it off. This practice is also objectionable, inasmuch, as the disease almost always recurs, its roots still remaining. Otherwise, a partial cutting off may be requisite in those cases where the cavity in which the polyp is seated is quite filled by it, for the purpose of introducing the instruments necessary to tear it away or cut it off.

The extensive experience of Dupuytren, however, proves that considerable bleeding, after cutting off a polyp, and its recurrence, are not more frequent than after the other modes of treatment; at least such is the case with polyps of the womb, *rectum*, and *pharynx* (Pigné.)

2317. *Tying a polyp* is specially indicated where it is situated deeply, and on an organ which, on account of its yielding, will not allow tearing away; further, when the polyp has a broad firm base, and also, when severe bleeding is feared, if any other practice be followed. As the polyp, after being tied, swells and enlarges, because, on account of the situation of the arteries in the middle of its root, the circulation is not completely arrested, except in the superficial veins, tying must not be had recourse to when the polyp is so situated, that the functions of more important organs are disturbed or destroyed by its swelling; and even considerable bleeding may be caused by this mode of treatment. It must also be observed, that in many cases tying is extremely difficult, and the repeated introduction of the instrument rendered necessary. By a gentle graduated drawing together of the ligature severe pain may indeed be prevented; but in many instances it requires tightly tying, by which violent pain is produced; and in very inflammatory subjects, this is caused even by very slightly tightened ligature. When, after a polyp has been tied, it begins to be destroyed, a flow of extremely stinking ichor ensues, which affects the neighbouring parts, and is very troublesome to the patient.

2318. *Destroying a polyp with the actual cautery*, is only applicable when the polyp bleeds on the slightest touch, and the patient has become greatly exhausted by the previous bleedings; when the polyp cannot be satisfactorily managed in any other way; and lastly, when it is malignant or cancerous, and its speedy removal is requisite. In some cases of polyps in the *antrum Highmorianum*, other escharotics may also be employed (*a*).

A.—OF POLYPS IN THE NOSTRILS.

De Jussieu, B. et J., Dissert. ergo ex ligatura Polypi Narium tutior curatio. Paris, 1734.

Leviet, Observations sur la Cure Radicale des plusieurs Polyps de la matrice, de la gorge et du nez, opérés par de nouveaux moyens inventés. Paris, 1749.

Palluci, Ratio facilis atque tuta narium curandi Polypos. Viennæ, 1768.

Pott, P., Remarks on Polypus of the Nose; in his Chirurgical Works, vol. iii. p. 209. Edition of 1783.

Desault, De la Ligature des Polypes des Narines; in his Œuvres Chirurgicales, vol. ii. p. 501. Edition of 1812.

Klug, Dissert. Historia instrumentorum ad Polyporum extirpationem, eorumque usus chirurgicus. Balæ, 1797.

Kreysig, Dissert. de Polypis Narium. Vitembergæ, 1802.

Deschamps, Traité des Maladies des Fosses Nasales et de leur sinus. Paris, 1804.

(*a*) Schmidt, R., Comment. chirurg. de Polyporum congestione. Berol., 1829. 4to.; cum tab. xv.

Petit Radel, Considérations sur les Polypes des Fosses Nasales, et les moyens auxquels jusqu'ici on a eu recours pour leur guérison. Paris, 1815.

Meissner, above cited, p. 144.

Gruner, Dissert. de Polypes in cavo Narium obviis. Lipsiæ, 1825; cum tab. iv.

2319. Polyps occur more frequently in the nostrils than in any other cavity. They arise either from the walls of the nostrils or from the frontal sinuses; they may even have their root in the *antrum Highmorianum*, and as they grow, may branch into the nostrils. They are most commonly situated on the upper outer wall of the cavity of the nose, and in their further development assume its form. They, therefore, enlarge usually at first vertically, and having reached the floor of the nostril, increase more horizontally; not unfrequently they grow towards the throat; oftentimes even in both directions, in consequence of which, the polyp is divided into two processes. There is commonly but a single polyp; yet not unfrequently several are produced at the same time, and even in both nostrils.

2320. The following are the symptoms caused by nasal polyps:—At first the patient complains of a long-continued snuffling, loses the power of smelling, has his nose stopped up, and a great discharge of fluid from it. These symptoms often vary, according to the state of the weather, and are more violent in damp, and less so in dry warm weather. In proportion as the polyp enlarges, the passage of the air through the nostril becomes more difficult, and at last the nose is completely filled; it projects through the external opening of the nose, or enlarges towards the throat, in which case it may considerably interfere with breathing and swallowing. When the increase of the polyp has become very great, the walls of the nostrils enlarge in every direction, the passage of the tears through their duct is stopped up, the nasal partition is thrust to the opposite side, in consequence of which the healthy nostril is narrowed, and at last all the bones are pressed out of their place. The discharge, which had hitherto been mucous, is sometimes streaked with blood, becomes ichorous and stinking; the polyp ulcerates, suppuration attacks the bones, and the disease, by wearing out the patient's powers, may cause death. The growth of the polyp is frequently accompanied with intense headache, which spreads over half of the face. Many polyps bleed very easily and violently, and thereby cause great weakening.

2321. Nasal polyps are either the so-called *hard polyps*, red soft, and sensible, although not causing any great pain; or they are *soft* or *mucous polyps*, of a leathery nature, of pale colour, accompanied with copious mucous secretion, and varying according to the state of the weather; or they are of a firmer character, of cartilaginous hardness, very painful, bleed on the slightest touch, and easily run into cancerous degeneration. Upon these differences rests their division into malignant and benignant.

The *malignant polyps* are those which from their beginning are accompanied with severe pain in the head or the upper part of the nostril, and when they appear externally have a pale red or livid colour, are very painful to the touch, bleed readily, are not movable, but firmly fixed, and attached at many parts to the mucous membrane; coughing and sniffing produce a painful sensation in the nose or in the fore part of the head: and there is a discharge of stinking ichor.

The *polyp* is *benignant*, when it has a grayish-white, pale, or brownish colour, is of a soft nature, is accompanied with little pain in its growth, and is not painful when touched; when occasionally it increases and then diminishes in size; when, excepting at its root, it does not adhere to any other part of the nostril; and when it is movable in sniffing, and secretes *mucus*.

2322. The *causes* of nasal polyps are in many instances doubtful. They may sometimes be produced by mechanical injury, poking the nose with the fingers, and other things; but, for the most part, the nasal polyps are so situated that these causes can have no influence. In general, a catarrhal affection of the mucous membrane of the nostril, a continued *blennorrhœa* is the origin of these polyps. In many cases, the polyp is causally connected with a general dyscrasic affection, as *syphilis*, suppressed natural discharges, and the like, which seems to be proved by the frequent production, at the same time and in the same nostril, of several polyps, by their frequent recurrence after removal, and by the accompanying symptoms of general ailment. The disposition to form polyps often seems connected with the natural development of the body, as they frequently occur at the period of puberty, or this unnatural formative activity is at least favoured by the loosening up of the mucous membrane; and truly the healthiest persons, who about puberty are subject to frequent bleeding from the nostrils are commonly affected with nasal polyps.

The bursting asunder and diseased changes of the nose-bones are not always simply the result of their mechanical separation by the polyp, but oftentimes the disease of the soft parts and of the bones, is co-existent, and both depend on one and the same cause; which is especially the case when the disease is produced and kept up by a dyscrasy (*a*).

Schreger notices a complication of polyp with unnatural enlargement of the vessels (*teleangiectasy*) of the mucous membrane, which seems specially proper to those cases in which the beginning of the polyp is long preceded by a phlogistic loosening up of the mucous membrane, together with *blennorrhœa;* yet they do not occur in polyps which form without them and quickly. It does, not, however, in all cases come to teleangiectasy, at least not to a great degree of it. The symptoms of this teleangiectasy are, a discharge of *mucus*, mixed with blood, during the primary *blennorrhœa*, diminution of the narrowing, and pressure in the nostrils, by spontaneous bleeding from the nose; and when the polyp is visible, it is redder, and thence towards its root, frequently of a bluish-red colour; the uneasiness is greater, the bleeding violent on touching, and the growth rapid.

According to Richerand (*b*), the benignant polyps spring from the mucous membrane, and the malignant from the bony walls of the nostril; except in those cases in which a vesicular or fibrous polyp runs into cancerous degeneration.

2323. The *prognosis* of nasal polyps depends on their nature, seat, origin, and complication with other diseases. The mucous polyps are least dangerous, and most easily managed; the harder, firmer, and more painful the polyp is, so much the more is its degeneration into cancer to be dreaded. As, however, polyps seem to assume the cancerous character during their growth, their removal as early as possible, seems the only means of preventing this degeneration. The more accessible is the seat of the polyp, the more movable it is, and the less its connexion with the walls of the nostril, the more easily may it be removed; and the more completely this is done, the less is its recurrence to be feared. When the polyp is connected with general disease, the latter must be first met by proper treatment, or otherwise, after the performance of the operation, the polyp will more certainly recur.

2324. Nasal polyps always require operation; but if early discovered,

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(*a*) Schreger, above cited, pp. 42, 43.

(*b*) Nosographie Chirurgicale, vol. iv. p. 324. 1821. Fifth Edition.

especially when of the mucous kind, the unnatural vegetative process of the mucous membrane may be checked, and the incipient formation of the polyp prevented, by the application of cold astringent fluids, by sniffing up powders of calomel, or oxysulphuret of antimony with sugar, by touching with tincture of opium, by purging, and corresponding general treatment.

The removal of nasal polyps may be effected by tearing away, by tying, by cutting off, and by destroying them with the actual cautery.

2325. *Tearing away a nasal polyp* is the most common and indeed the most suitable mode of cure, when the polyp, be it fleshy or mucous, is not deep seated, has not a very broad base, and is not very hard. For this purpose *polyp-forceps* are used, of different size, and either straight or curved. The blades of good polyp-forceps must be a little hollowed in front and rough, so that the polyp may be more firmly grasped; their edges must be neither very thin nor sharp, or the polyp will be easily snipped asunder; they must be broad and strong, and their handles sufficiently long (*a*).

Schreger (*b*) uses also forceps with disjointed parallel arms.

2326. Previous to tearing away the polyp, its extent and the place of its attachment must be carefully examined with a whalebone probe, which must be carried around it; the light made to fall properly into the nostril, and the finger passed upwards behind the soft palate; but the frequent irregular surface of the polyp, and the various projections of the walls of the nostril, render, in most cases, a certain knowledge of the seat of the polyp impossible. On the whole, however, this is not of so great consequence as generally supposed; since less depends on the seat of the polyp, than on its form and size, whether the polyp-forceps can be properly carried to its root.

2327. The *operation* is performed in the following way:—The patient being seated on a chair of corresponding height to that of the operator, and opposite the light, so that it may fall into the nostril, his head is held by an assistant standing behind him, who, placing his hand upon the patient's forehead, presses and fixes the head against his own chest. If the polyp do not hang quite loosely in the nostril, attempts must be made to loosen it with the whalebone probe, which should be carried round, and the patient, closing the healthy nostril, should blow forward the polyp as much as he can. The operator holds the forceps with the thumb and forefinger of the right hand by the rings of their handle, and passes them closed into the nostril up to the polyp, then opens them, and by twisting and turning them about endeavours to get the polyp between their blades. The patient must strive to force the polyp still further between the blades, whilst the operator, at the same time, tries to carry them up higher to the root of the polyp. The forceps are now closed, and being kept tight with the screw or the fingers, are twisted on their axis, and at the same time pulled, till the polyp be completely separated.

2328. The polyp is frequently removed from its root at one pull, and on sniffing the nose is quite pervious; but if such be not the case, if a portion of the polyp remain, if, perhaps, there be several polyps, the forceps must be again introduced, the remnant grasped and pulled out, as already directed. If there be not much bleeding, this must be repeated till the whole polyp is removed. The entire removal of the polyp is the

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(*a*) Richter's Anfangsgründe, vol. i. pl. v. fig. 1.

(*b*) Neuer Chiron, vol. i. part ii. p. 197 figs. 1, 2.

most certain means of checking the bleeding; but if this be dangerous, the operation must be suspended for a moment, and recourse had to the means already advised for arresting bleeding.

2329. When the polyp has acquired great size, when it protrudes through and stops up the nostril, the introduction of the forceps can then only be effected by seizing the front of the polyp with a pair of forceps held in the left hand, and drawing it forwards, and thus enlarging the space in the nostril. If, in such case, the commonly employed forceps cannot be introduced, a pair must be used with a separable joint, with their blades curved before the joint and meeting at their tip (*a*). Both blades must be separately introduced to the necessary height, then closed, and the polyp torn away according to the rules already given.

In Charrière's cleverly arranged polyp-forceps, the handles cross, so that when they rest upon each other the blades are open.

When the size of the polyp is such that it completely prevents the introduction of the forceps, it has been recommended to destroy with caustic, or to slice off the part filling up the nostril.

2330. When the forceps cannot be passed up to the root of the polyp on account of its size, the result of tearing it off is always very doubtful, as the polyp may be either torn away at its root, or only that part grasped by the forceps be pulled off. In the latter case there is generally great bleeding, which is best stanched by the complete removal of the polyp.

2331. If the polyp be rooted far back in the nostril, and hang down behind the soft palate into the throat, it is thought best by some practitioners to draw it through the mouth; for this purpose a pair of curved forceps are introduced through the mouth, behind the soft palate to the polyp, which is to be grasped as high as is fitting, and pulled away; and if any portions remain they can usually be removed through the nostril. It is, however, more convenient to pass the forceps through the nose into the throat, and guide them by the finger introduced behind the soft palate, with which at the same time the polyp may be pressed between the forceps. In general, tying the polyp is indicated in these cases.

Tearing away the polyp with a noose, in preference to using the forceps, is in every case to be avoided.

2332. Bleeding always follows tearing off a polyp; this is often very great, and as it cannot be known before the operation, to what extent this may be, the necessary means for arresting it should be in readiness. The danger of bleeding is always less when the whole polyp and its root are pulled off; but if only part be torn away the bleeding is considerable, and the surest mode of stopping it is the complete removal of the remnant. The means used for arresting bleeding are, sniffing up or injecting cold water, vinegar and water, Theden's arquebusade, solution of alum, and the like; or a bit of linen or lint soaked in an astringent fluid and rolled up, must be passed with the forceps, or a screw probe up to the bleeding part. If the nostril be very wide, pressure may be made with the finger. If these means be ineffectual to arrest the bleeding, the hind and front openings of the nostril must be plugged with Bellocq's tube, which is to be introduced through the nose into the throat, and the spring it contains thrust forward, so that it may project from behind the palate into the mouth, and to the knob at its end a double thread must be attached, with a sufficiently thick plug at its extremity. To the pad a second thread must be

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(*a*) Richter, Anfangsgründe, vol. i. pl. v. fig. 2.—Schreger, above cited.

added for the purpose of pulling it out afterwards (1). The spring is now to be drawn back into the tube, the instrument removed from the nose, and the pad, by means of the thread, brought into the hind opening of the nostril so as to close it. The two threads hanging out of the nostril are to be separated and between them as much torn lint passed into the front opening of the nostril as will stop it up, and then the two threads are to be tied on the lint. An elastic catheter may be used instead of BELLOCQ's tube.

[(1) BELLOCQ's canula is one of the most clever and handy instruments ever invented, and admirably fitted for plugging the nostril, or for introducing a thread any where, in which, without it, great difficulty, waste of time and annoyance, if not indeed great pain to the patient, are experienced. I brought it five and twenty years since from Paris, and have frequently used it with the greatest facility. It is an instrument which every practitioner should always have about him, and ought to be found in every pocket-case. It is not necessary to have any additional thread passing through the arch of the *fauces* and mouth for the purpose of pulling the plug back, which is always best withdrawn by drawing it gently through the front opening of the nostril, pulling the thread by which it has been introduced so soon as a purulent discharge begins from the nostril, which generally occurs about the third or fourth day; but the plug must not be meddled with till then, as if it be the clot in the bleeding vessel is disturbed, and the bleeding returns, and requires the plug to be again introduced. I prefer a piece of very soft dry sponge, as nearly as possible corresponding to the size of the nostril, or even a little larger, which must be carried quickly through the mouth and throat to the hind opening of the nostril, otherwise it will soon be filled with moisture, and cannot be introduced till it has been clipped so small that it is useless. When the sponge has entered the nostril it must be gently drawn forwards till the bleeding cease, when it is to be left, and as it expands with the blood it soon fills up, and adapts itself to the whole cavity of the nostril. Stuffing the front opening of the nose is quite unnecessary, if sponge be used; and if the bleeding do not stop, the practitioner may be sure the sponge does not reach the bleeding vessel, and must arrange it properly by introducing a probe through the front opening of the nostril, and varying the position of the sponge till the bleeding be arrested, which is done easily, although in general drawing the sponge forward with the thread is sufficient. Sometimes there is a little difficulty in getting the sponge through the arch of the *fauces*, as it catches the soft palate, and pulls it either directly against the spine, or up against the back of the nostril; it is therefore best always to keep the sponge close to the knob of the spring, as it is then most manageable. The thread by which it is attached should, therefore, be merely threaded in the eye of the knob, one long end left out at the mouth, and the other carried with the spring into the nose, and having been brought out first at the front of the nostril, there left. The canula is then, with its knob drawn close up, to be drawn back along the thread through the throat, and then by pulling the end hanging from the nostril, the other end of the thread with the sponge is easily pulled into the throat. If the sponge catch upon the soft palate, it may be quickly freed by passing the finger into the arch of the *fauces*, and gently slipping the palate down over the sponge, when all difficulty immediately ceases. The explanation of this proceeding requires many words, and may seem tedious, but the whole operation from the first introduction of the canula till the proper placing of the sponge, ought not to occupy at furthest a couple of minutes, but often not half that time if the rules just given be attended to. If BELLOCQ's canula be not at hand, a common bougie serves the purpose as well as an elastic catheter; it must be bent to the curve of a common catheter, and carried along the floor of the nostril into the throat. The patient opens his mouth widely, and the end of the bougie being seen, is grasped with dressing forceps, and drawn forwards till it protrude from the mouth. A strong thread is now tied to the end of the bougie, having a piece of sponge attached to its loose extremity; after which the bougie is gently pulled back through the mouth, throat, and nose, bringing with it the thread and the sponge, which is brought into the nose as directed already. This is much more tedious, and, compared with the former, a more clumsy proceeding, but is a good makeshift.

Any bleeding from the interior of the nose may be managed readily in the same way. —J. F. S.]

2333. If, after the operation, inflammation ensue, it must be managed by suitable treatment, but generally it soon subsides. When the bleeding has been stopped by the plug, the lint may be withdrawn from the front of the nose on the third day, and the hinder plug pulled out by the thread hanging from the mouth. If there be suppuration in the nostril some mild decoction may be thrown up.

To prevent the recurrence of the polyp astringent injections are generally used. Perhaps a seton in the neck might do good service. If the polyp grow again the operation must be repeated.

2334. *Tying a nasal polyp* avoids indeed the danger of bleeding, but leads to other results, and in my opinion has not the preference over tearing it off, which is given by some practitioners. The application of a ligature is indeed, in most cases, accompanied with considerable difficulty, and to the patient with no trifling inconvenience. If the polyp largely fill the cavity of the nostril, the ligature can very seldom be applied sufficiently close to its root; its earlier return after having been tied is therefore to be feared, although indeed, in some instances, when the ligature has not been applied directly on the root, the whole polyp has been thrown off by subsequent inflammation and suppuration. The inflammation which occurs after a polyp has been tied, often spreads over the whole Schneiderian membrane and the neighbouring parts, and may produce serious symptoms. The swelling of the polyp after tying, as well as the subsequent discharge of stinking ichor, may give rise to great inconvenience. The peculiar states of the disease, which may specially indicate tying, are, therefore, when the polyp has a broad firm base, when the application of the forceps is impossible, or when the patient will not submit to its being torn off.

A pouch-like protrusion of the inner fold of the mucous membrane, if it cannot be removed by the use of astringents, or by repeated scarifications, is favourable for tying, but not for tearing off. Internal disease in connexion with this complaint must have suitable treatment. When this protrusion of the mucous membrane is very extensive, it is only got rid of with great difficulty, or not at all.

2335. Of the numerous modes of proceeding which have been recommended for tying nasal polyps, I consider the introduction of the ligature with Bellocq's canula and Desault's method to be the most preferable. The former specially applies to polyps at the back of the nostril, and the latter to those in front. The best material for a ligature is a silken or hempen thread.

2336. The application of a ligature with Bellocq's canula is managed in the following way:—The patient having been put in the same position as in that for tearing off the polyp, Bellocq's tube is passed between the foot of the polyp and the neighbouring wall of the nostril into the throat. On the protruded knob or in its eye, a long hempen or silken thread is fastened, and with the instrument drawn back into the nose. After the thread has been loosened from the knob, Bellocq's tube is again passed between the wall of the nostril on the other side, and the foot of the polyp, and the end of the thread hanging in the mouth is attached to the knob of the protruded spring, and drawn back through the nose. In this way a loop is formed with the thread, the two ends of which encircle the sides of the polyp. The two ends of the thread hanging from the nose are brought into the end of a loop-tier, which is introduced to the foot of the polyp, and the loop is in a degree tied together by drawing its ends, according to circumstances. The loop-tier is to be wrapped in lint, so that it may not irritate the nostril; and its projecting end supported in the usual manner.

As the loop when moist does not remain open, and in drawing it together the polyp is not always grasped, it is necessary to guide it with the fingers of the left hand behind the soft palate. To the loop catching the polyp, another of a single thread is attached, with which, when the former being drawn does not catch the polyp, it may be pulled back through the mouth, and so the necessity of reintroducing it with Bellocq's canula be avoided. The loop may be kept open by drawing the thread in a piece of elastic tube, which when the thread has caught the polyp, may be so removed that one end of the thread may be drawn till the tube appears (*a*). The tie is made as already directed. For polyps which are developed towards the upper hinder part of the nostril towards the throat, I make use of a peculiar pair of forceps for the more certain introduction of the thread (*b*). Hatin has also proposed a similar instrument. It is further advantageous in these cases to pass the ends of the thread, before drawing them, into a loop-tier or a Levret's tube, and to introduce it as far as possible into the nostril, for the purpose of thereby giving the loop a more vertical direction (*c*).

2337. In tying a polyp situated in the front of the nostril, according to Desault's method, a silver canula slightly curved upwards, and a loop-drawer, are introduced up to the root of the polyp, with one ligature through the cavity of the former and the hole of the latter. The loop-drawer is given to an assistant, who holds it steady, and the Surgeon then carries the canula round between the polyp and the wall of the nostril, and back to the loop-drawer. The drawer is now to be taken with one, and the canula with the other hand, so that both instruments cross, and the thread at the upper end of the canula lies above that of the loop-drawer. The drawer is now held steady, and the canula brought back, both ends of the ligature introduced into the hole of a loop-tier, which is passed up to the root of the polyp, and the loop-drawer removed after it has been freed from the ligature by pushing forwards its stem. The tying is managed as before (*d*).

In cases where, on account of the large size of the polyp, the introduction of instruments is impossible, the soft palate has been cut through, which, however, is rarely necessary.

The following works may be consulted upon the different modes of proceeding, and the different instruments requisite for carrying a loop around the polyp, instead of tying or cutting it off:—

Glandorp's Tractatus de Polypo Narium. Bremen, 1828, describes an eyed hook.

Dionis, Cours d'Opérations de Chirurgie, p. 464. Eighth Edition. Paris, 1777, gives his crow-beak forceps.

Junker et Gorter, Conspectus Chirurgiæ, p. 221. Halæ, 1731. Chirurgiæ repurgata, p 202. Viennæ, 1762; in which are mentioned the flexible needles.

Heister, Instructiones Chirurgicæ, vol. ii. pl. xix. fig. 12, gives his eyed probe.

Levret, above cited, pl. v. fig. 9, in which Lecat's forceps are shown.

————; in Mémoires de l'Académie de Chirurgie, vol. iii. p. 598, pl. vii. fig. 3. Journal de Médecine, vol. xxxv. p. 235, gives his single and double cylinder.

Bell, Benjamin, System of Surgery, vol. iv. p. 132. 1787. Second Edition—describes Eyckholdt's mode of treatment.

Theden; in neue Bemerkungen, und Erfahrungen zur Bereicherung der Wundarzneikunst, vol. ii. p. 195, pl. iii. figs. 1, 2. His forceps.

Hatin, A. F., Mémoire sur de nouveaux instrumens propres à faciliter la ligature des Polypes qui naissent de la base du Crane. Paris, 1829.

(*a*) Dubois, Propositions sur diverses parties de l'Art de guérir. Paris, 1818.

(*b*) Ueber die Einrichtung der chirurg. Klinik zu Heidelberg, 1820. Pl. i figs. 2, 3.

(*c*) Sabatier, Médecine Opératoire, vol. ii. p. 218.—A. von Winter, Geschichte eines äusserst grossen Rachenpolypen, durch die Abbindung ausgerottet, nebst allgemeinen Bemerkungen über die Ausrottung der Rachenpolypen überhaupt; in von Siebold's Chiron, vol. iii. p. 315, pl. v.—Zang, Operationen, vol. i. p. 483.

(*d*) Desault, above cited, vol. ii. p. 227.—Bichat; in Mémoires de la Société d'Emulation, an ii. p 333, gives a modification of Desault's method; but, according to my experience, not more practicable.—Schreger und Harless, Annalen der Englischen und Französischen Literatur, vol. i. p. 378, figs. 1-6.—Zang, above cited, vol. i. p. 487, pl. i. figs. 2-7.

Hatin, A. F., Supplément au Mémoire sur de nouveaux Instrumens propres à faciliter la Ligature des Polypes du Nez et de la Gorge. Paris, 1830.

Sach's, A., Beschreibung des elastichen Ligaturwerkzeuges and birnförmigen Brenneisen. Berlin, 1830.

2338. As soon as the polyp is tied it begins to swell and become painful; in a few days it crumples up and mortifies, and a stinking ichor flows from the nostril. The pain is often very severe, and the inflammation spreads; under these circumstances the loop must be slackened a little. If the polyp swell up so much as to produce symptoms, the loop must be so tightened, that all influx of blood into the polyp be prevented, and the polyp may also be scarified at the same time. When there is bleeding the loop must also be well tightened. To lessen the nasty smell from the discharged ichor, injections of aromatic herbs or of diluted acids are often made. The loop must be tightened every day till the polyp fall off, and when it has been loosened by the ligature cutting in, it may be seized with the forceps and torn off; and after its separation, astringent injections must be used for some time. When the polyp is expected to fall off, the patient should be carefully watched, lest it drop into the throat and cause symptoms of suffocation.

2339. *Cutting off a nasal polyp* is alone indicated when it is rooted near the front of the nostril, has a tendinous stem and no broad base; also if the front of the polyp so block up the orifice of the nose, that it is impossible to introduce the forceps or tying-instruments. Bleeding and recurrence after cutting off a polyp are specially to be feared.

2340. The polyp may be cut off with either scissors or a curved bistoury. It must be seized with a pair of hook-forceps, and drawn a little forwards; the scissors are then to be passed into the nostril, where most convenient, up to the foot of the polyp, which is then cut through and withdrawn. If a bistoury be used, **Pott**'s, with its blade covered with sticking plaster to within half an inch of its button, may be carried up to the stem of the polyp, which it cuts off whilst drawn forward. If the bleeding after the operation be not much, it may be stanched by a wad of lint moistened with some styptic. In severe bleeding the means recommended (*par.* 2332) may be used. If the bleeding part can be readily got at, the actual cautery may be also employed. If the polyp be disposed to grow again, it may perhaps be prevented by the cautious application of escharotics.

Besides the cutting forceps of **Fabricius ab Aquapendente**, **Severinus**, and others, special instruments for cutting off polyps have been recommended by the following writers:—

Levret, above cited, pl. iv. figs. 11–14.

Perret, L'Art du Coutelier, pl. cxii. fig. 3.

Whately's Cases of two extraordinary Polypes removed from the Nose; the one by excision with a new instrument, the other by improved forceps. London, 1805.

Booth, Thomas; in London Medical Repository, vol. xiii. p. 283. 1820.

Schreger, above cited.

2341. The *Application of the Actual Cautery* should only be had recourse to when the polyp bleeds on the slightest touch, when the patient has been much weakened by repeated bleedings, and when the polyp so blocks up the entrance into the nostril, that it cannot be removed in any other way. A trocar-tube wrapped round with moistened linen is passed up to the polyp, and the space between the tube and walls of the nose stuffed with wet lint. A white-hot trocar is then thrust through the tube so deeply, and so directed into the polyp as is believed will hit the polyp in its greatest diameter. The polyp is not in this way at once destroyed, but a violent degree of inflammation is produced, and it is got rid of by suppuration. The inflammation, severe headache, and fever, which follow the use of the actual cautery, must be diminished by mild fluids injected into the nostril, by due quietude and proper antiphlogistic treatment. If suppuration ensue, soothing injections must be employed; but it continues a long time, till the whole polyp has been destroyed by suppuration. When it has once lessened, the polyp may perhaps be torn off, or any small remnant got rid of by cautiously touching it with lunar caustic.

B.—OF POLYPS IN THE THROAT.

2342. *Throat-Polyps* may be rooted in the hind part of the nostrils, and grow towards the cavity of the throat; or they may grow from the back of the palate, or even from the walls of the *pharynx* itself. These polyps are in general of a more firm and fleshy nature, and usually attached by a short thick stem. In proportion to their size, they cause pressure and irritation of the tissues of the throat, cough, choking, and difficulty of breathing and swallowing. The rubbing to which such polyps are subjected by the touch of the food in swallowing, very commonly produces a continued irritation of their surface, and even ulceration. The discovery of a throat-polyp is very easy, so soon as it has acquired any size.

2343. The structure of these polyps, and the nature of the parts with which they are connected, render it impossible, or at least very dangerous, to tear them off; only in those cases where they are attached by a thin loose stem, can this be undertaken with the forceps. The best mode of treatment is tying them, which in general is most conveniently done in the same way as recommended (*par.* 2336) for nasal polyps passing into the *pharynx*. If the polyp more conveniently permit tying through the mouth, Desault's apparatus is best suited for that purpose.

Special instruments for tying throat-polyps are recommended by Dallas (*a*), by Theden (*b*), and Roderick (*c*); and an improvement of the latter by Braun (*d*).

2344. The symptoms, after tying a throat-polyp, are generally violent, as, by its swelling, the breathing is considerably interfered with, and even danger of suffocation may ensue. Tightening the ligature and scarification of the polyp are the only means of lessening the symptoms. If there be bleeding, the ligature must be tightened till all circulation in the polyp be stopped. When the polyp begins to be loose, it may be pulled off with the forceps; which must be also done when, from the putrescence of the polyp, the stench is unbearable, and the neighbouring parts are affected by the ichor which escapes.

2345. The just-mentioned method of rotting off polyps is applicable only to those which are above the narrow passage of the *œsophagus*. But if the polyp arise from the wall of the *œsophagus* itself, it can only be brought into the throat in choking, and as it cannot remain there for a moment without suffocation, it is impossible to tie it. For such cases Zang proposes laryngotomy, which having been performed, and the polyp brought into the throat, it may be tied (*e*).

(*a*) Edinburgh Physical and Literary Essays, vol. iii. p. 525.

(*b*) Above cited.

(*c*) Richter's Chirurg. Biblioth., vol. ii. part i. fig. 8.

(*d*) Salzb. Med.-Chir. Zeitung, vol. iii. p. 429, figs. 1—3. 1811.

(*e*) Operationen, vol. i. p. 502.—Benj. Bell's System of Surgery, vol. iv. p. 108.

According to **Benjamin Bell** (*a*), for those polyps situated in the *œsophagus*, a slip-loop should be passed down, which by frequent retractions, may catch the polyp, and then the curved double cylinder should be passed down to it.

C.—OF POLYPS IN THE MAXILLARY SINUS.

Bordenave, Précis d'Observations sur les Maladies du Sinus Maxillaire; in Mém. de l'Acad. de Chirurg., vol. iv. p. 329.

Becker, (præsid. C. **Siebold**,) Dissert. de insolito Maxillæ superioris tumore aliisque ejusdem morbis. Wirceb., 1776.

Runge, Dissert. de Morbis præcipuè Sinuum ossis frontis et Maxillæ superioris. Rintel, 1750; in **Haller**, Disput. Select., vol. i.

Jourdin, Traité des Maladies et des Opérations de la Bouche. Paris, 1778.

Desault, Œuvres Chirurgicales, vol. ii. p. 165.

Deschamps, Traité des Maladies des Fosses Nasales et de leur Sinus. Paris, 1804.

Eichhorn, Dissert. de Polypis, speciatim de Polypis in Antro Highmori. Götting., 1804.

von Siebold, B., Sammlung seltener und auserlesener chirurgischer Beobachtungen, vol. i. ii.

Leinicker, Dissert. de Sinu maxillari, ejusdem morbis iisque medendi ratione. Wirceb., 1809.

Weinhold, Ueber die abnormen Metamorphosen der Highmorshöhle. Leipzig, 1810; with a plate.

————, Ueber die Krankheiten der Gesichtsknocken und ihrer Schleimhaüte, u. s. w. Halle, 1818.

Adelmann, Untersuchungen über krankhafte Zustände der Oberkiefer-Höhle. Dorpat, 1844; with three plates.

2346. I shall now treat, not merely of polyps, but also of all the other diseases which may be produced in the Highmorian cavity, and set out with *inflammation of its mucous lining*, as the first step of these various diseases, which, according to their different course, and the causal relations of the inflammation, may produce a *blennorrhagic state*, *ulceration*, *loosening up of the mucous membrane*, *polypous degeneration*, *sarcoma*, *caries*, *exostosis*, *osteosteatoma*, and *osteosarcoma*.

2347. *Inflammation of the mucous membrane of the Highmorian cavity* has either an acute or an insidious course; most commonly the latter, and therefore, in general, it is not at first noticed. The symptoms of this inflammation are at the onset a burning, throbbing pain, which extends from the edge of the teeth into the orbit, not externally, but in the maxillary cavity itself, and not increased by external pressure. According to the kind of inflammation, this pain is either very severe and constant, with increased heat, head-ache, and febrile symptoms; or it is slight, and then only supposed to be a slight catarrhal affection, and not attended to.

2348. If the inflammation do not disperse, it may, if acute, and in healthy, robust persons, run on to suppuration; but generally it acquires a blennorrhagic character, with a feel of constant dull pain, not increased by pressure, but it soon attacks the teeth, and becomes severe and obstinate. The patient blows from his nose puriform fluid, streaked with blood; or it escapes into the nose when the head is laid on the other side. By the continuance of this blennorrhagic affection, the mucous membrane of the Highmorian cavity gradually become swollen, and its opening of commu-

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(*a*) Above cited.

nication with the nostril is narrowed, or completely stopped up. The unnaturally secreted fluid, which is either puriform, lymph-like, actual pus, or even a solid cheese-like substance collects in the cavity, which it expands; at the same time the cheek is reddened to a certain extent, the nostril of the affected side becomes drier, the pain becomes more severe, loss of sleep, and the like, ensue. As the maxillary cavity continues enlarging, its walls expand, in general, most towards the front, but also towards the orbit, towards the nostril, and towards the palate; in consequence of which great disfigurement of the face, closure of the nostril of the affected side, pressure on the eyeball, and the like, are produced. The bony walls, by their expansion, become thinned, and sometimes so soft that they yield on pressure of the finger; at last they are destroyed at some one spot, fistulous openings are produced in the cheek, in the orbit, in the palate, and most commonly at the edge of the tooth-sockets, from which pus escapes, and a probe can be passed into the maxillary *sinus*.

2349. The above-mentioned inflammatory symptoms, more or less decidedly pronounced, always precede the formation of polyps, *osteosteatoma, osteosarcoma*, and *exostosis*, in the maxillary cavity.

Polyps grow quickly, expand the cavity in all directions, destroy the front wall or the edge of the tooth-socket, and burst through these openings; the walls of the cavity being at the same time softened. Frequently the polyp passes through the aperture of the cavity into the nostril; sometimes it rises more especially towards the inner angle of the orbit; at other times leaves the front wall untouched, drives up into the cavity of the skull, and may cause death by pressure on the brain.

In *osteosteatoma* and *osteosarcoma*, the bones forming the maxillary cavity are converted into a mass, consisting in part of a viscid, pappy substance, in part of a fat or tallow-like substance, and in part of a cartilaginous and bony substance. The enlargement of the tumour caused by a polyp always runs on more quickly than in that from *osteosteatoma* and *osteosarcoma*.

2350. Inflammation being considered as the general groundwork of the diseases of the maxillary *sinus*, the following may be mentioned as its *causes*. External violence, catching cold, rheumatic, gouty, scrofulous and syphilitic diseases; suppressed eruptions of the skin, *caries* at the roots of the teeth corresponding to the maxillary cavity, injury of the tooth-sockets in drawing teeth, foreign bodies, insects, and the like. The different terminations of inflammation of the maxillary cavity, seem in part to depend on the variety of its causes, as for example; in catarrhal and rheumatic affections of the mucous membrane of the bones of the face, its upper layer especially, is attacked, and the inflammation passes on to *blennorrhœa*, loosening up, and polypous degeneration of the mucous membrane, whilst gouty and syphilitic inflammation rather attack the under layer of the mucous membrane, which blends with the *periosteum*, and more quickly runs into ulceration and degeneration of the bones.

2351. The *prognosis* of the various diseases of the maxillary cavity is guided by their cause and degree. In the acute course of the inflammation, if not caused by internal disease, its dispersion may be effected by proper and early treatment, but it is generally more difficult in dyscrasic affections. When the disease has proceeded to a closure of the aperture of the maxillary *sinus*, and to organic changes, the cure is always tedious, and impossible without operation. In the blennorrhagic state, in collection of *mucus*, or lymph-like fluid in the cavity, the *prognosis* is more favourable than in polyps, and the above-mentioned degeneration of the bony walls. In the further progress of polyps, *osteosteatoma* and *osteosarcoma*, cancerous degeneration not unfrequently ensues, a condition which is beyond aid.

2352. In considering the *treatment* of the different conditions of disease in the maxillary *sinus*, that of its inflammation must be first taken up.

Acute inflammation must be treated strictly antiphlogistically, free blood-letting, leeching, and cold applications to the cheek. If it have been caused by external violence, and any separation of the walls of the *sinus* be supposed to exist, moderate pressure must also be made. If the inflammatory tension be thereby relieved, then, in catarrhal or rheumatic affection, recourse must be had to diaphoretic treatment and to purgatives. If there be restlessness and loss of sleep, to these remedies must be added opium in moderate doses, rubbing in opium powder and spittle on the cheek, and at night a strong camphorated *belladonna* plaster applied.

2353. When the inflammation is chronic or becomes so, which is generally the case in any causal relation with dyscrasic affections, the treatment must be specially regulated by the disease on which it depends. If there be a blennorrhagic condition, loosening up of the mucous membrane, which is to be feared when there is a discharge streaked with blood, injections of astringent decoctions must be made into the nose, purgatives, and according to WEINHOLD's experience, specially, a snuff composed of ten grains of calomel, and two drachms of sugar, or from two to three grains of sulphuric oxide of mercury, and a drachm of sugar, and tincture of *digitalis*, in connexion with remedies which counteract the existing dyscrasy, and in such doses as will depress the vascular action.

2354. When the disease has proceeded to closure of the aperture of the maxillary *sinus*, and there is any collection in it, or a blennorrhagic condition, or the ulceration which has taken place in the cavity, even whilst its aperture is still open, cannot be cured, or if polyps or other kinds of degeneration have formed, *opening the maxillary sinus* remains the only remedy; by means of this, the unnatural collection is emptied, the diseased secretion got rid of, and the diseased production removed or destroyed.

In estimating this operation, the diseased conditions requiring it must be considered, whether the general affection on which they depend, is, or can be removed. *Blennorrhœa* and ulceration are more easily cured than polyps, *osteosarcoma*, *osteosteatoma*, and *exostosis*. In these cases the after-treatment is always extremely difficult, the after-products are easily reproduced, and not unfrequently run into cancerous degeneration. When these after-products are very largely formed, the neighbouring bones are involved in the diseased change, or manifestly assume a cancerous condition, and the patient's powers being already much sunken, the operation will only hasten his death.

2355. The various spots at which opening the maxillary *sinus* has been proposed are, *first*, the alveolar socket of the second, third, or fourth molar tooth (*a*); *second*, the *fossa canina* (DESAULT); *third*, the under part of the zygomatic process between the second and third molar tooth (*b*); *fourth*, the bony palate; *fifth*, where any one part of the cavity is very thin or perforated; *sixth*, boring through the cheek, or at the same time, also through the palate (WEINHOLD.) If there be a fistulous aperture, it

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(*a*) COWPER, Anatomia. Oxford, 1697.—DRAKE, Anthropologia. London, 1707.

(*b*) LAMORIER; in Mém. de l'Acad. de Chirurg. vol. iv. p. 351, pl. iii. B. C.

may, especially if corresponding with the bottom of the *sinus*, be sufficiently enlarged.

The reopening of the closed aperture of the *sinus* by injection, by the use of probes, and the like, according to JOURDAIN (*a*), as well as the perforation of the wall of the *sinus* in the nose, after RICHTER's plan (*b*), when the cavity protrudes much towards the nose, are objectionable.

2356. *Opening the maxillary sinus through the tooth-socket* is then only to be undertaken, *first*, when it contains fluids, *pus* or *mucus*; *second*, when the tooth-socket itself is specially diseased, when there are also carious teeth, or they are very painful when touched, when there is *caries* of the socket, or fistulas have formed between the molar teeth or in their sockets. The second, third, or fourth molar tooth is then to be pulled out, and whilst an assistant properly fixes the patient's head and draws down the corner of the mouth with a blunt hook, a trocar, without its canula, is to be passed into the tooth-socket and thrust into the *sinus;* or the alveolar process is to be penetrated with a perforator, and the opening enlarged to such degree that the collected fluid may escape freely, and the state of the cavity be properly examined.

[Opening the maxillary *sinus* through the tooth-socket, is the most preferable mode of performing this operation; and although thrusting in a trocar is usually recommended, it is far more convenient to use the instrument formerly employed for introducing a canula into an obstructed nasal duct, as the extremity of its stem being bent at right angle, can be more handily introduced after the tooth has been drawn. Not unfrequently, the sharp end of a tent probe bent at right angle readily thrusts through the little shell of bone separating the tooth-socket from the *sinus*. And it is not even an uncommon circumstance to find that either this plate has been absorbed, or one fang of the tooth has penetrated the *sinus*, so that immediately the tooth is pulled out, the pus escapes.—J. F. S.]

2357. The escape of the matter is furthered by soothing fluids or lukewarm water, with which the patient should frequently wash his mouth, and at the same time, force it into the aperture. If there be any pieces of exfoliated bone on the alveolar process, they must be picked off with the forceps. Any contrivance for plugging up the aperture is unnecessary, and also hurtful, by shutting up the fluid in the cavity. If the patient every day push the tip of his little finger into the opening, that will be sufficient to prevent it closing too quickly. Whilst taking food, however, the aperture should be plugged with a little bit of sponge, and afterwards the mouth again washed out.

When there are ulceration and *caries*, which are discovered by the character of the discharge and by the probe, means for supporting the general health must also be employed besides the local treatment; and any loose pieces of bone removed with the forceps.

In a blennorrhagic condition and loosening up of the mucous membrane, a solution of bichloride of mercury, of sulphate of zinc with tincture of opium, or the like must be used. The introduction of a small portion of red precipitate ointment on a probe is of good effect. With this local treatment must be connected general remedies corresponding to the state of the health.

When by these proceedings the secretion of the mucous membrane has become healthy, attempts should be made by sternutatives to render the natural opening again pervious, after which the opening in the tooth-socket will close. If, however, the aperture cannot be restored, it must be sought to get rid of the secretive activity of the mucous membrane. According to WEINHOLD (*c*) this should always be the object of the treat-

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(*a*) Above cited, p. 50.
(*b*) Anfangsgründe, vol. ii. p. 360.
(*c*) Von den Krankheiten der Gesichtsknochen, p. 23.

ment, as the cure is only effected when secretion ceases, and the whole cavity filled with granulations. For this purpose Weinhold recommends as especially advantageous, diluted tincture of capsicum, and solution of nitrate of silver.

[The restoration of the original aperture between the maxillary cavity and the nostril, is not of the slightest consequence; at least, so far as the cases I have seen, prove. Weinhold's notion, I do not think, is any thing worth, or at all likely to be correct, for as soon as the pus has escaped by the hole in the tooth-socket, the inflammation subsides, and the lining of the maxillary cavity resumes its natural function. But if the pus have been very long pent up, and the mucous membrane destroyed, it is more probable there will be exfoliation of the bony walls, than that the whole cavity will be filled with granulation. I have not, however, seen any case where either one or other such result has occurred. Weinhold's recommendation of injecting stimulating solutions cannot be too strongly deprecated, as being fraught with mischief, and should never be followed. It is not, however, objectionable to inject warm water for two or three days after the tooth has been drawn, and the cavity tapped, as thereby it is more quickly cleansed, and the healthy processes are encouraged.—J. F. S.]

2358. *Boring into the maxillary cavity in the fossa canina* is indicated when the teeth and alveolar process are healthy, in collections of fluid, and polypous and other degenerations. The patient sitting on a stool, his head is fixed by an assistant against his breast, and the corner of the mouth on the affected side drawn down with a blunt hook. The cheek is to be separated at the front edge of the base of the zygomatic process, in the direction of the second or third molar tooth, by a cut through the gum; the *periosteum* is to be cut through cross-wise, and the flaps cut off with scissors. Upon the bared bone a perforating trephine is then applied and made to penetrate rather obliquely from below upwards through the wall of the maxillary cavity. An examination is made with a probe to ascertain whether there be any after-production, and if there be, to what extent this hole should be enlarged. If necessary, it must be widened first with the pointed and afterwards with the blunt perforator; and if the wall be soft, this may be done with a strong curved knife; and the opening should always be made sufficiently large to introduce the finger. A small-crowned trephine may also be useful in perforating the cavity at this part (*a*).

2359. The further treatment is guided by the state of disease. In *blennorrhœa* and ulceration the same proceeding is adopted, as after perforating the tooth-socket. Any after-products existing in the maxillary *sinus* must be removed according to their nature, by cutting away, tearing off, tying, or by destroying them with caustic.

2360. *Cutting away* cannot be employed if the polyp have a broad base, as there is always then danger of severe bleeding, and recurrence of the disease. The polyp is to be drawn well forward, and cut off with the bistoury, or with Cooper's scissors: the bleeding must be stanched with wadding moistened or strewed with styptics and pressure, or by the application of the actual cautery.

Tying is rarely possible, and *tearing off* the polyp with straight or curved forceps, having grasped it as near as possible to its root, is always to be preferred.

Destruction with caustic is only proper when the disease cannot be got at in any other way. For this purpose, butyr of antimony, caustic potash, or best of all, lunar caustic, are employed; a strong solution of the latter, on lint, being introduced into the cavity.

The *actual cautery* is only to be employed when the other remedies are

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(*a*) Desault, above cited, vol. ii. p. 166. pl. i. figs. 1, 2, 3.

fruitless, and even then with great caution. For this purpose, a metallic tube, wrapped in wetted linen, is passed into the opening up to the midst of the after-product, and a trocar, at white heat, thrust through it. If the unnatural vegetation be by these means stopped, and if hard granulations sprout up, they may be treated with astringents till the scarring is completed.

2361. The object of *boring into the maxillary cavity below the eminentia molaris, and above the third or fourth molar tooth*, is the same as that for boring in the *fossa canina;* and the indications are also the same. The patient having been placed as already described, and the corner of the mouth drawn down, the gum and *periosteum* are divided at the part determined, and the bony wall is bored obliquely from below upwards, and from without inwards, with the perforator. The further proceeding is the same as in boring in the *fossa canina.*

2362. *Boring into the maxillary sinus through the palate*, when the palate is much altered by disease, and another situation cannot be conveniently chosen, or *at any one part*, where the cavity is very thin or burst through, is easily managed from what has been already said on the different modes of boring; the after-treatment is also guided by the same rule.

2363. For *boring into the maxillary sinus upon the cheek*, WEINHOLD proposes several modes of proceeding. If the disease be *blennorrhœa*, and loosening up of the mucous membrane, with narrowing and closing of the aperture, in which the object is to do away with the secretive activity of the mucous membrane, the *needle-trephine* (*a*) must be applied on the bone, and an aperture made, rather obliquely upwards, through the distended cheek into the maxillary *sinus*, four lines from the zygomatic process towards the nose, and the same distance from the lower edge of the orbit, and then as it is rotated, the front wall of the cavity is pierced. The perforator may also be applied with the same purpose, but instead of the needle-trephine after having cut into the cheek. A plug is then introduced into the opening, and fastened to the temple by a thread; it may also afterwards be smeared with red precipitate ointment, and a solution of nitrate of silver, or properly diluted tincture of capsicum may be injected, till the mucous membrane is destroyed (*par.* 2357.)

2364. If the after-products, polyps, steatomes, fatty growths and the like, or the secretion of the mucous membrane are to be destroyed, the needle-trephine armed with a thread in its eye should be introduced at the appointed place, and whilst the handle is a little raised, the point is carried so downwards through the maxillary *sinus*, that it penetrate the palate some lines distant from the third molar tooth. In doing this, the tongue is to be protected from injury by the forefinger of the left hand, and the point of the trephine thrust so far out, that the thread in its eye can be reached with a hook. The trephine is now withdrawn, and the thread left behind, by which either a firm cord or a plug of tape is introduced, and these are to be smeared with remedies proper for destroying the after-products. In fatty swellings the string should be frequently drawn backwards and forwards, and moistened with oil of turpentine, and as much as possible of the mass removed with DAVIEL's spoon. For the destruction of polyps or sarcomatous degenerations, the plug should be smeared with a solution of lunar caustic, of bichloride of mercury, with red precipitate ointment, and the like. To prevent the acrid fluid escaping into the mouth, to that part of the string hanging in it a thread should be attached, and whilst

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(*a*) Ideen über die krankhaften Metamorphosen der Highmorshöhle, fig. 1.

the upper part of the string is pulled up, the thread must be drawn through the upper opening of the cavity, and separated from the string. To the lower part of the thread a piece of sponge or a wad of lint is attached, which must be pressed firmly against the opening in the palate, whilst the upper end of the thread is pulled up. The upper part of the string is then smeared with some of the just-mentioned escharotics, and replaced in the *sinus*. If the string be gradually made thicker, it favours the cure.

According to HEDENUS, the seton, after the lip has been separated from the upper jaw, should be drawn within the mouth through the front wall of the maxillary *sinus* and the palate, by means of a curved needle (*a*).

2365. In deciding on the different modes of proceeding for opening the maxillary *sinus*, it must be remembered that in collections of mucus and pus, when there are also *caries* and *necrosis* of the alveolar process, and of the walls of the *sinus*, the principal object must always be to form a sufficiently large opening, so that the collected fluid may freely escape, and the loose pieces of bone be removed. For such cases, under the circumstances above mentioned, (*par.* 2356,) boring through the tooth-socket or in the *fossa canina* is best. The introduction of a seton according to WEINHOLD's method is very advantageous for destroying many after-growths. There are, however, degenerations of the maxillary *sinus*, in which not merely the mucous membrane, but even the bones are completely changed in their tissue, to which neither of the above-mentioned modes of treatment are applicable; and the removal of the after-products is alone possible by taking away the greater part of the bony wall so as to get at them; or the bone may be divided to the whole extent of the after-product, as will be directed for the removal of the upper jaw. As to the special performance of this operation, nothing decided can be laid down; it must depend on the peculiarity of the case, the circumstances allied to which will be hereafter noticed, in treating of removal of the upper jaw. In the former case it must be attempted to penetrate the front wall of the *sinus* by a semi-circular cut above the alveolar process with a sickle-shaped knife, and by a like cut through the palate also, so as to cut out an elliptical portion of the bony wall. The after-product must now be removed with polyp-forceps, or if its adhesions be firm, it must be taken away with the knife. The bleeding during this operation is always severe, and requires, if pressure with wads of lint be insufficient, the actual cautery; this is best managed with a bent trocar, of which the canula is wrapped in wet linen. The actual cautery should not be applied very smartly to destroy the after-product, because it may produce severe and dangerous reaction. At first, after the operation, the treatment must be antiphlogistic and soothing, according to circumstances. When suppuration is set up, it must be sustained by smearing the lint with digestive, and strewing it with irritating powders. If all the after-product be not removed, or if it be not destroyed by the actual cautery, and a new growth ensue, it must be destroyed by escharotics, of which nitrate of silver is best. It is self-evident that in this local treatment, the state of the powers and any causal dycrasy must not be forgotten, but met with corresponding treatment.

In consequence of a diseased tooth, its root may expand the surrounding socket, and form a pretty spacious cavity, unconnected, however, with the maxillary *sinus*. Drawing

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(*a*) GRAEFE und WALTHER's Journal, vol. ii. part iii. p. 387. —WEINHOLD, in same, vol. iii. part i.

the tooth, and removal of the front wall of the socket, are sufficient for the cure. After the removal of teeth, the roots of which extend into the maxillary *sinus*, fistulous openings often remain between them, through which occasionally some saltish fluid escapes into the mouth; if left alone, these fistulas are of no consequence.

2366. The same diseased conditions which render the opening of the maxillary *sinus* necessary, may also require the frontal sinuses to be opened, as their mucous membrane is subject to the same changes as that of the maxillary *sinus*. In boring into the frontal *sinus*, the bone is to be laid bare at that part where it is most expanded, and the external plate penetrated with a trephine. The after-treatment must be conducted according to the nature of the disease, just as after opening the maxillary *sinus*.

A peculiar affection of the maxillary *sinus* must be here mentioned, which has been specially noticed by DUPUYTREN, consisting of a development of a cellulo-fibrous swelling, enclosed in a proper cyst, besides the mucous lining of the cavity. This tumour, of which the consistence varies according to its age, if examined, presents in its structure an approach to that of a fibrous polyp, but does not seem to have any great disposition to cancerous degeneration. At first it is little inconvenient; as it grows it distends the walls of the *sinus*, especially in front, and thins them so that they form merely a thin plate which is yielding, gives way to pressure, and by its elasticity rises again with a sort of crackling, like that produced by pressing a bladder half filled with air. This symptom, which is pathognomic, fades away after repeated examination. A cut from the infraorbitary hole to the corner of the mouth lays bare the distended wall of the bone, and with a common bistoury a sufficiently large opening, or even a crucial cut, may be made into it. The swelling may be seized with a hook, or with MUSEUX's forceps, and easily pulled out. It is, however, very difficult to get out the cyst at the same time, and therefore, in most cases, it is necessary to stuff the cavity with lint, and to destroy it by inflammation and suppuration. A moderate degree of pressure will assist the return of the bony walls to their place (PIGNÉ.)

D.—OF POLYPS OF THE WOMB AND OF THE VAGINA.

LEVRET, above cited.

———, Sur les Polypes de la Matrice et du Vagin; in Mém. de l'Acad. de Chirurg., vol. iii. p. 518.

HERBINIAUX, Parallèle de différens instrumens et méthode de s'en servir, et de pratiquer la ligature des Polypes dans la Matrice. A la Haye, 1771.

GOERTZ, Dissert. sistens novum ad ligaturam Polyporum Uteri instrumentum. 1783.

WALTHER, De Polypis Uteri; in Ann. Academ. Berol., vol. i. p. 20. 1786.

NISSEN, Dissert. de Polypis Uteri, novoque ad eorum ligaturam instrumento. Gotting., 1789.

STARK, Ueber Mutterpolypen und Umkehrung der Gebärmutter; in STARK's Neue Archiv. für Geburtshülfe, u. s.w., vol. i. part iii.

HEINZE, Dissert. de Ortu et Discrimine Polyporum, præcipuè Polyporum Uteri. Len., 1790.

ZEITMANN, Dissert. de Signis et Curatione Polyporum Uteri. Jenæ, 1790.

ROTHBARTH, Dissert. de Polypis Uteri. Erfurt, 1795.

SEGARF, Dissertation sur les Polypes Utérins. Paris, an XII.

LEFAUGHEUX, Sur les Tumeurs circonscrites et indolentes du Tissu cellulaire de la Matrice et du Vagin. Paris, 1802.

ROUX, Mémoire sur les Polypes Utérins; in his Mélanges de Chirurgie et de Physiologie.

HAUK, Ueber Gebärmutter Polypen; in Rust's Magazin, vol. iii. p. 263.

MAYER, De Polypis Uteri. Berol., 1821.

BOIVIN ET DUGES, Traité pratique des Maladies de l'Utérus et de ses annexes, vol. i. p. 333. Paris, 1833.

Besides which many observations may be collected from writers on nasal polyps.

2367. *Polyps of the womb* are formed either in its *fundus*, its body, or its neck. In general they resemble each other in having a long pear-shaped form with a thin neck, in being of a fleshy or fibrous structure, and in being covered with a smooth shining skin. Various differences are however observed, as they are sometimes round with a broad base, have an uneven, cleft surface, and their internal structure is sometimes more soft and spongy; at other times more tough, and sometimes having cavities which contain different kinds of substances. Sometimes they are very vascular, and at other times contain few vessels. Their size differs, and is sometimes very great. Mucous polyps are rarely produced.

I have seen a polyp, which though rooted in the cavity of the womb itself, hung out two inches below the *fissura magna*, in structure resembled a mucous polyp, and at its lower edge it had fringed lobes, and an aperture through which a thick probe might be passed to its root.

Upon mucous polyps in the womb, in old women, accompanied with *leucorrhœa*, but without bleeding, (hypertrophic mucous sacs,) NIVET and BLATIN (*a*) may be consulted.

2368. The *symptoms* characterizing a polyp of the womb are, at first, very doubtful; whilst small it causes no remarkable inconvenience to the womb. As it increases, it often excites squeamishness, disposition to vomit, weight and dragging in the loins and region of the *sacrum*, shooting and itching in the breasts. The walls of the womb are gradually distended by the polyp; its vaginal portion becomes shorter, thicker, and harder, and the lower portion of the womb is larger than usual. By the continued growth of the polyp, the mouth of the womb is at last opened, when an escape of bloody fluid, and often violent bleeding, takes place, and the polyp protrudes through the mouth, either gradually or suddenly, on every exertion, in jumping, falling, going to stool, and the like, with pains like labour pains, and dragging of the generative organs. If the polyp protrude into the *vagina*, it enlarges quickly, causes pressure on the bladder and *rectum*, and consequent difficulty in voiding the urine and stools; the pain in the lumbar and sacral regions becomes greater, and there is often considerable bleeding, occurring either of itself, or from any exertion, shaking of the body, or the like. These bleedings depend on the constriction which the polyp suffers from the mouth of the womb, in consequence of which the blood collects and the vessels burst. The discharged blood is sometimes very red, sometimes black, sometimes brownish or watery, mingled with flocks and fibres, and excessively stinking; sometimes whole pieces of clotted and very filthy-smelling blood are discharged. Sometimes no blood escapes, but only a quantity of *mucus*-like serous fluid, which greatly weakens the patient. The growing polyp at last protrudes from the *vagina*, and appears externally. By the weight of the polyp, the womb is constantly dragged and pulled down, and there is, consequently, a sensation of continual dragging and tension in the belly; eversion of the womb may ensue, the discharge of urine be greatly interfered with, the belly blown up and painful, repeated bleedings, the general health considerably affected, the breathing becomes difficult, dry cough, loss of appetite and hectic fever may ensue, and death follows, either from continued pull upon the constitutional powers, or suddenly from bleeding. As the polyp protruding from the *vagina* is exposed to the air and to the contact of the urine, constant irritation is kept up on it, and hence often ulceration is produced.

(*a*) Archives Générales de Médecine, vol. iii. p. 195. 1838.

2369. If a polyp form on the neck, or in the neighbourhood of the mouth of the womb, it is noticed earlier, as it soon protrudes into the *vagina*, and does not distend the womb as when rooted in its *fundus;* it causes pressure on the bladder and *rectum*, and rarely bleedings, as it is not constricted by the mouth of the womb; by its weight the womb is pulled and dragged down; the neck and mouth of the womb often so swells, that the bound between it and the polyp is completely lost. In consequence of the irritation of the womb kept up by the polyp, scirrhous or steatomatous degenerations may be produced.

A polyp arising from the *fundus* of the womb, when sinking downwards, may become adherent to the wall of the *vagina*, and so have two roots; it may, therefore, when quickly protruding through the external generative organs, evert the womb and the *vagina*, in consequence of which, according to its seat on the latter, there may be produced a hollow in the *rectum*, where it corresponds with or on the *peritonæum*, where it is attached to the *vagina*. If the protruded part of the *vagina* do not differ from the stem of the polyp, it may be tied with it in the operation (*a*).

2370. The *symptoms* produced by the development and further progress of polyps, may give rise to their being mistaken for pregnancy, eversion, and prolapse of the womb, fungous growths, and scirrhous degenerations.

2371. As long as the polyp remains in the cavity of the womb it *may be mistaken for pregnancy;* the *diagnosis*, however, rests on the following circumstances. In pregnancy the vaginal portion of the womb is only gradually distended; it is elastic and feels soft, the mouth of the womb remains closed, and opens only during labour. With polyp the internal mouth of the womb opens without true pains, and remains oftentimes long open, without the vaginal portion being so regularly expanded, without being soft and thin, and without the lips of the womb-mouth so completely disappearing. The mouth of the womb with the polyp is harder, in pregnancy softer. The menstrual discharge is rarely suppressed with polyp, but irregular, more frequent, and not rarely painful; the blood is paler, watery, mingled with fibrous parts; and there is, in addition to the discharge, a mucous ill-smelling fluid, like water in which flesh has been washed. In pregnancy menstruation occurs only in rare cases, but is regular, as concerns its coming on and character. The general symptoms occurring at the beginning of pregnancy diminish and entirely disappear in its progress; but with polyp, on the contrary, they increase. The enlargement of the belly in pregnancy is greater and more regular; but with polyp is more unequal, does not attain the size of pregnancy, and depends on the growth of the polyp. The enlargement of the breasts is not so gradual with polyp of the womb as in pregnancy; they are sometimes full, sometimes flabby, and never so large. To conclude, the continuance of pregnancy is definite, and, at a certain time, the movements of the child are perceptible. In mole-pregnancy, the distension of the belly and the alteration of the vaginal part of the womb, which shortens and softens, takes place more quickly; the mouth of the womb remains closed till the mole is protruded, which happens suddenly and not gradually; there, also, is not the discharge as with polyp.

2372. As to the *mode of distinguishing a polyp which has protruded through the mouth of the womb from eversion of that organ*, it must be observed that in incomplete eversion, the swelling passing through the

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(*a*) Berard, (Thèse,) Observations relatives aux Polypes de l'Utérus et à quelques-unes des Maladies des Organes Genito-Urinaires. Paris.

mouth is broad above and narrow below; hence also the mouth of the womb is always more open than with polyp, as that has a directly contrary form, being broad below and narrow above. In eversion, which is not of long standing, the replacement of the womb is in general possible, in consequence of which the pains are lessened, whilst after such attempts the polyp always protrudes again. The polyp is less sensitive than the everted womb. Eversion usually occurs after a very recent labour; the polyp is more movable than the everted womb, its surface is smooth, and the bending in of the *fundus* of the womb may be felt through the walls of the belly, if the eversion be any wise great. Complete eversion resembles polyp in the form of the swelling, as it is narrow above and broad below, but it is surrounded by the mouth of the womb like a fold. With polyp the finger, or a probe, may be passed deeply between it and the *vagina*, but it cannot be by the side of the everted womb. The stem of a polyp is hard, the upper part of the everted womb is yielding, because it is hollow. Eversion occurs after a birth.

Notwithstanding these different signs, the distinction of polyp from everted womb, especially if partial and of long duration, is very difficult, so that the most able practitioner cannot be certain without examining by the touch. As, however, as has been already noticed, (*par.* 1287,) the form as well as the sensibility and mobility of the polyp varies; both swellings may have a smooth or an irregular surface; the polyp may appear soon after delivery; examination of the belly affords, in stout persons, no definite result, and with a polyp rooted at the *fundus* of the womb, the *fundus* may be, in its further protrusion, dragged down, and a certain degree of eversion produced (*a*.) Careful observation seems to prove the fact that a polyp, when it has once passed through the mouth of the womb, grows quickly.

2373. The mistaking a polyp which has descended into the *vagina* for an imperfect prolapse of the womb is not very possible, as the polyp is softer and less sensitive than the protruded womb, has generally a bean-shaped form, without any opening at its lower part; and when at this part there is even a pit resembling the mouth of the womb, no probe can be introduced into it; replacement is impossible with a polyp, though it may be effected with prolapsed womb and the pain thereby relieved. If the finger or a probe be introduced between the polyp and the *vagina*, it may pass deeply, whilst, on the contrary, in prolapse it is soon stopped. In prolapse there is no repeated bleeding. In complete prolapse of the womb the distinction is still more easy.

2374. Fungous growths are distinguished from polyps of the womb in that they are the consequences of a scirrhous state of that organ, the mouth of which is hard, painful to the touch; is even more or less irregularly shaped, and bleeds on the slightest touch. Scirrhous swellings of the mouth of the womb are characterized by the feel of gnawing and burning, by stabbing, boring pain, which at first remits, but afterwards is continual; by a copious white discharge which corrodes the parts; by the discharge of pieces of black blood, by very great hardness of the swelling, irregularity, and pain when touched.

2375. The *causes* of polyps of the womb are in many cases unknown. Irritation of the womb, repeated difficult deliveries, frequent connexion,

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(*a*) Chelius; in Heidelb. klin. Annal.

onanism, venereal discharges, and the like, may frequently produce them; but more commonly they arise without any such previous ailment; and they have been noticed even in young girls. Most commonly they occur about the period of the cessation of the menstrual discharge, when the altered vital condition of the womb favours unnatural productions. They are very rarely seen in old women.

2376. The *treatment* alone consists in the removal of the polyp by operation. Only in rare cases has it been noticed that the constriction of the polyp by the mouth of the womb has caused its complete separation and cure. The result of the operation is the more favourable in proportion to the ease with which the stem of the polyp can be got at, and the less thick and firm it be. When there has been for a long time great loss of blood, other symptoms quickly arise after the operation which require particular treatment. So long as the polyp is still not large, it is covered with a membrane connecting it with the womb, and which tears as the polyp grows. Hence the reason why the operation on large polyps is commonly attended with slighter symptoms than the smaller; hence after the operation the recurrence of the disease is generally less to be dreaded than after nasal polyps.

When there are other organic changes of the womb, scirrhous hardening and the like, the *prognosis* is extremely unfavourable, as after the removal of the polyp it more quickly terminates fatally. Polyps of the womb do not hinder conception, but generally abortion takes place; pregnancy, however, may reach its natural termination.

2377. Of the generally proposed methods for the removal of polyps, *tying* and *cutting off* are the most proper for those of the womb; pulling or twisting off, and destruction by escharotics, are inapplicable, partly on account of the yielding nature of the parts in which the polyp is rooted, and partly on account of the condition of the space (1). The operation can only be undertaken in polyps of the womb when they have protruded through its mouth into the *vagina*. Before undertaking it a review must be taken of the cause of the disease, and of the patient's constitution. Hence a preparatory treatment is sometimes necessary; for instance, in syphilitic disease by using mercury; and in those persons who have been very much weakened by bleeding, by strengthening remedies, and the like.

(1) Mayor (*a*) has vindicated twisting off.

2378. The number of instruments which have been proposed for tying polyps of the womb is very great; they may be arranged comprehensively under the three following heads:—

First. The ligature, which is carried round the root of the polyp by means of a double tube, or two separate tubes, or stems, connectable together, and tightened by means of these tubes. To these belong Levret's double cylinder (*b*), and forceps (*c*), with the modifications of Keck (*d*), Laugier (*e*), Buttet (*f*), Contigli (*g*), and Clarke (*h*); also the

(*a*) Note sur l'Extirpation des Polypes utérins par torsion; in Gazette Médicale de Paris, vol. xii. p. 529. 1844.

(*b*) Mém. de l'Acad. de Chirurg., above cited, pl. xiii.

(*c*) Journal de Médecine, vol. xxxii. p. 531, fig. 1—6. 1770.

(*d*) Ibid., vol. xxix. p. 529.

(*e*) Journal de Médecine, vol. xxxiii. p. 363. 1770; vol. xxxv. p. 173. 1771.

(*f*) Ibid., p. 66.

(*g*) Raccolta di Opuscuolo Medico-practici, vol. iii. p. 139.

(*h*) Observations on those Diseases of Females which are attended by Discharge. London, 1814; with ten plates.

instrument of David (*a*), Klett (*b*), Loeffler (*c*), Cullerier (*d*), Goertz (*e*), and Nissen (*f*); with the alterations of Joerg (*g*), Meissner (*h*), and Gooch (*i*).

Second. The loop is applied with the assistance of a loop-drawer around the polyp, and its tying managed with a single tube, or with a loop-tier. Here belong the apparatus of Herbiniaux (*j*), Stark (*k*), Desault (*l*), with Bichat's modification (*m*), John Hunter (*n*), and Ricou (*o*).

Third. The loop applied around the root of the polyp, with a loop-drawer, and tied together by the use of little rings, through which the two ends of the ligature are passed. Such are the rosecrown instrument of Boucher (*p*), Loeffler's alteration (*q*), Sauter's (*r*) combination of it with Ribke's instrument (*s*).

2379. Of these several instruments for tying polyps of the womb those only will be here mentioned, as being most suitable, which were employed by Desault, and the tier of Nissen and Ribke. Previous to the operation the *rectum* must be emptied with a clyster. The patient is to be placed on a bed or table, so as to be in a half lying, half sitting posture, and the *perinæum* and region of the *coccyx* exposed. The thighs must be separated by an assistant, and a careful examination made to ascertain the nature and seat of the polyp.

2380. Desault's apparatus is to be employed as above mentioned (*par.* 2337.) A pretty strong ligature must be passed through the eye of a loop-drawer, and to a silver tube somewhat curved forwards, and the end of the ligature fastened on one ring of the silver tube. This and the loop-tier are now carried parallel to each other between the swelling and the wall of the womb on that side where there is least resistance, and by slightly moving it laterally, carried to the upper part of the stem of the polyp. That end of the ligature attached to the ring of the tube being loosened, the loop-drawer is held fixed with the left hand, whilst with the right the tube is carried round the whole swelling and back to the loop-drawer. The hands are now to be used instead of the instruments, and so crossed over each other that the part of the loop which the tube draws with it may pass over that held by the loop-drawer. The tube is now drawn back, whilst the drawer is kept steady, the two ends of the thread passed into the opening of a loop-tier, and this pushed up to the root of the polyp, whilst the ends of the thread are held fast, the stem of the loop-drawer is then pressed forwards, the ligature removed from its aperture, and the drawer removed. The two ends of the ligature are now drawn sufficiently tight, and fastened to the notch of the loop-tier.

(*a*) Loder's Chirurgische Bemerkungen, vol. i. pl. ii. fig. 4 and 5.

(*b*) Stark's Archiv. für die Geburtshülfe, vol. iii. p. 548, fig. i.–iii. A. C.

(*c*) Ibid., vol. iv. p. 308.

(*d*) In Lecfaucheux, above cited.—Hufeland und Harless, Neues Journal, vol. ii. p. 196, pl. 2.

(*e*) Above cited, fig. 1, 2.

(*f*) Above cited.

(*g*) Handbuch der Krankheiten des Weibes, fig. iii.-vii. Lipz. 1821. Second Edition.

(*h*) Above cited, fig. i.-vi.

(*i*) An Account of the most important Diseases peculiar to Women. London, 1829.

(*j*) Above cited, pl. i.–iii.

(*k*) Stark's Archiv. C. I., p. 152, figs. i.-iv.

(*l*) Above cited, pl. iv.—Hasselberg, Comment. chirurg. in quâ novum humeri ex articulo exstirpandi methodum, novumque ad ligaturam Polyporum instrumentum proponit. Gryph., 1788.

(*m*) Mémoires de la Société d'Emulation, an II. p. 33.

(*n*) In B. Bell, above cited.[1]

(*o*) Mémoire et Observations sur les Polypes Utérins, avec un nouvel instrument pour en faire la Ligature; in Museum der Heilkunde von der helvetischen Gesellschaft correspondirender Aerzte und Wundaertze, vol. ii. pl. v. Zurich, 1794.

(*p*) Beinstein; in Loder's Journal, vol. ii. p. 626, pl. x.

(*q*) Hufeland's Journal. 1813; part iv. p. 65.

(*r*) von Siebold's Chiron, vol. ii. p. 420, pl. vii. figs. 1–8.

(*s*) Rust's Magazin, vol. iii. p. 153.

This mode of treatment is very worthy of recommendation on account of its ease and certainty. The objection that the ends of the ligature, not being contained in a tube, may be softened and loosened by the continual moisture, is, according to my experience, groundless. If it be desirable to measure each time the degree of tightening, that may be easily done by means of a stop-wheel placed at the end of the loop-tier.

2381. NISSEN's polyp-tier is used in the following manner:—The instrument well oiled, and having a thread unlooped attached to it, is passed with the forefinger of the left hand up to the root of the polyp. The handle by which the two tubes are connected is now removed, and one tube being held steadily, the other, with its concavity towards the polyp, is carried round it to its fellow, and the two are then connected by slipping on and pushing forwards the rings, and attaching the handle. The ligature is now drawn closely together and fastened; or it is tightened with the screw as recommended by JOERG.

2382. In using RIBKE's instrument, the two loop-drawers are introduced, like the single blades of delivery-forceps, up to the root of the polyp, the stem which holds the two cylinders together is drawn out, and then each of the latter is carried round in a half circle till they meet again, and are then fastened together with the stem. The assistant, who has hitherto held the stop-wheel, now presses the knobs to the upper end of the connected cylinders, after which the stilettes in the latter are drawn so far out at the lower opening that the loop is set free, and the cylinders can be withdrawn. The root of the polyp is now tied and properly fastened by the stop-wheel, which is laid on a pad upon the *mons Veneris*, and confined there by a broad cloth around the loins.

2383. The symptoms which may occur after the tie has been made are, violent inflammation and fever, pain, spasm, bleedings, and other symptoms from pressure of the swelling polyp. In the first case suitable antiphlogistic treatment must be employed; in spasm, narcotic remedies used, and if the symptoms be not diminished by these, the loop must be slackened a little; the bleeding must be stopped by more tightly tying the ligature, and with astringent injections. On account of the increasing bulk of the polyp it is generally necessary for the first few days to empty the bladder with the catheter, and the *rectum* by clysters.

2384. The patient must after the operation keep perfectly quiet in bed; and have a proper diet. Every two days the ligature must be tightened; and to prevent the effect of the stinking ichor, repeated injections of decoctions of aromatic herbs must be employed. When the polyp has dropped off, which depends on the thickness and toughness of its root, and occurs at different periods, either by the continued tightening of the ligature, or on some movement of the patient, the injections must be continued for some time. Strengthening remedies must also be given to support the patient's diminished powers.

When the polyp, after having separated, is still retained, in consequence of its size, it must be withdrawn with forceps, for which purpose delivery-forceps and much force are often requisite; as happened to me in one case. If bleeding occur on the dropping off the polyp, astringent injections must be used, which are not, however, to be very irritating, or great irritation of the womb will ensue. If, notwithstanding the repeated tightening of the ligature, the polyp will not separate, which, however, is very rarely the case, it is advisable, to save the patient the inconvenience of the continued stench, to cut it off below the ligature.

In large, long-continued and far-extending polyps, it is possible that the *fundus* of the womb may be dragged down, the ligature must therefore not be tied too high up. I have related a fatal case of this kind (*a*).

2385. *Cutting off polyps of the womb*, the oldest method, is, on account of the danger following, and the difficulty of stanching the blood, only to be employed in particular cases, for instance: *first*, when the polyp, after having been tied fast during several days, has not dropped off, in which case, generally, considerable pain follows every tightening of the ligature; *second*, when the polyp hangs down, or can easily be drawn out, if its neck can be got at, is thin, and there have been no previous bleeding; *third*, when the polyp has produced eversion of the womb, accompanied with dangerous symptoms, which can only be got rid of by the quick removal of the polyp. SIEBOLD (*b*), however, not only in *this*, but in all *other* cases, prefers cutting off to tying a polyp of the womb, when it has a neck and can be reached, whether it be at the *fundus*, in the body, or at the neck of that organ. If in consequence of the breadth of the base by which it is attached to the *fundus* or body of the womb, cutting off the polyp be not possible, he ties it, for the purpose of contracting the stem, and then cuts it off below the ligature. This mode of proceeding is less painful, more speedy, unattended with any particular symptoms, without fear of bleeding, and even should that happen, it is easily stanched by plugging; the patient is not inconvenienced by a hateful smell and discharge, may leave her bed in a few days, and has little fear of a relapse. DUPUYTREN's repeated operations in this way entirely confirm SIEBOLD's statements (PIGNÉ); and although practice shows that the result after cutting off the polyp may be fatal (*c*), so on the other hand it shows that after tying, there may be severe, and even fatal bleeding (*d*).

2386. Cutting off a polyp of the womb is to be performed in the following manner:—The patient being placed in the same position as for the operation for the stone, an assistant presses on the belly to force down the womb, whilst another keeps the *labia* asunder. The polyp being found in the *vagina*, a speculum with movable branches is introduced, and the walls of that passage are expanded with it, so as to isolate the polyp, which is then seized with MUSEUX's forceps and the speculum withdrawn. Whilst the polyp is gradually drawn down, another pair of MUSEUX's forceps are to be applied higher up and at another diameter, and the drawing down is to be continued, whilst the patient holds her breath and forces, till the neck of the womb and the stem of the polyp are seen, when it is to be cut off with scissors or with a knife. The accompanying pain is only very little, there escape only a few drops or a teaspoonful of blood, the womb rises again, and a few days are sufficient for the cure. When the neck of the polyp is still engulfed in the womb, the neck of the latter must be cut into to reach the stem of the polyp (DUPUYTREN.) If the polyp protrude at the external generative parts, it is only taken hold of with the fingers or forceps and drawn a little out. The scissors for the performance of this operation should be curved on their flat surface, have their end rounded,

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(*a*) Heidelb. klin. Annalen, above cited.

(*b*) Handbuch zur Erkenntniss und Heilung der Frauenzimmerkrankheiten, vol. i. p. 710. Second Edition. 1821.—HERVEZ DE CHEGOION, Remarques sur la disposition anatomique des Polypes de la Matrice, sur l'emploi de la Ligature et sur les avantages de la resection de ces tumeurs; in Journal Général de Médecine. 1827; vol ci. p. 1.

(*c*) MAYOR, above cited.

(*d*) AMMING, Einige praktische Bemerkungen ueber die Gebärmutterpolypen und ihre Entfernungsarten: in Med. Jahrbüchern des östr. Staates. Neuste Folge, vol. vii. part ii. p. 285.

and be provided with long handles (Siebold) (*a*). The previous application of a ligature around the neck of the polyp, after drawing it down, and before cutting it off, which is recommended by some practitioners, Dupuytren and others consider unnecessary. If there be bleeding, cold injections should be thrown up, cold applications made to the belly, and plugs of lint, strewed with or steeped in astringents, introduced.

2387. *Polyps of the vagina*, as regards the symptoms they produce, and the treatment they require, are of less consequence than those of the womb. They are soon discovered by examination, and only when very large, cause pressure on the bladder and *rectum*. Their causes are inflammation, and injury of the *vagina*, venereal poison, and the like.

Their *removal* is either effected by tying, which is little difficult, and often done merely with the hand, or by cutting off; and the same rules are to be followed as in the operation for polyps of the womb.

[Occasionally a vaginal polyp will, from some accidental cause, separate of its own accord, without any surgical aid; an instance of this kind occurred to me a few years since.—J. F. S.]

F.—OF POLYPS OF THE RECTUM.

Desault, above cited, vol. ii. p. 498.

2388. *Polyps of the rectum* are situated either near the verge of the *anus*, and are then external, or they are deeper seated, and can only be protruded in going to stool, or even remain concealed in the gut. They are generally round, not large, necked, and of a pale-red colour. Sometimes there is only one, but at other times several.

2389. Those polyps which constantly lie out of the *rectum*, may be grasped with forceps, drawn down, and taken off at their root with a stroke of the bistoury, or with the scissors; and this applies also to such as are situated higher, but can be forced out. If, however, the polyp be seated so high, that it will not be forced out of the *rectum*, the ligature is the only remedy, and is best applied according to Desault's method.

XVII.—OF CANCER.

(*Cancer*, *Carcinoma*, Lat; *Krebs*, Germ.)

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(*a*) Mayer, above cited, figs. i. ii. iii.

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TRAVERS, BENJAMIN, Observations on the Local Diseases termed Malignant; in Med.-Chir. Trans., vol. xv. 1829.

HODGKIN, THOMAS, M.D., On the Anatomical Character of some Adventitious Growths; in Med.-Chir. Trans., vol. xv. 1829.

2390. That degeneration is called *Cancer* which is the consequence of ulceration of a *Scirrhus*, has a decided disposition to destroy all parts without distinction of their nature, which never heals, and which having arrived at a certain height, produces peculiar general disturbance.

2391. Two distinctions are established in reference to the origin of cancer; it is either developed from a previously formed *scirrhus*, or it arises from some other swelling, or some other ulcer in which the scirrhous degeneration has been set up.

2392. In the first case different periods may be distinguished in the development of the cancer. There arises generally without any known cause, sometimes in consequence of external violence, a defined tumour, or a swelling of some one organ which is generally quite free from pain, though rarely very sensitive; from the first it is very hard, irregularly knobby, and heavy, though sometimes regularly elastic on the surface, and soft at some parts. The skin covering the tumour is in its natural state; the substance of the organ in which it is formed, is usually increased; though sometimes it crumples together, and is then firmer. These symptoms designate the first stage of cancer (*Scirrhus*). The continuance of this stage is indefinite, though mostly long, and especially the harder the swelling, the older the individual, the less vascular the organ, and the more all dynamic and mechanical irritation be wanting, and the secretions and excretions remain natural. The general health is commonly undisturbed during this period, and the countenance unchanged; sometimes, however, various derangements, loss of power, wasting, earthy countenance, irregular febrile action and the like appear, by which a more speedy progress of the disease is indicated.

2393. Of its own accord, or in consequence of some evil influence upon the swelling it becomes irritable; the patient feels shooting, and excessively painful stabbings, or has the feel of constant burning in the tumour. The hardness and the extent of the hardness constantly increase, it becomes more knotty and knobby; the skin covering it is bluish-red, tense, adhering to the surface of the swelling, and the veins upon it swell (*Concealed cancer, Cancer occultus*, Lat.; *verborgener Krebs*, Germ.). The neighbouring lymphatic vessels and glands swell, become hard and painful, the constitution is more or less disturbed, loss of appetite follows, indigestion, wasting, and cachectic earthy countenance.

2394. Under aggravation of the above symptoms the thinned skin at last breaks, and an ichorous, bloody, brownish, or limpid fluid escapes, without the bulk of the tumour being in the least diminished; an ulcer is formed with hard edges and with irregular surface; very painful fungous growths spring up; an excessively stinking ichor is discharged; the neighbouring glands, even those lying beyond the course of the lymph, swell, and all parts are destroyed by the ulcer spreading in every direction after they have first assumed a scirrhous state. Bleedings frequently come on, the body wastes considerably, the skin assumes a peculiar yellowish-gray colour, the countenance has the characteristic impress of deep-seated disease; collections of serum are formed in the cellular tissue, and in the cavities; peculiar frangibility of the bones; hectic fever with nightly sweats, and colliquative *diarrhœa*, and the powers of the patient are exhausted.

2395. If a *scirrhus* be examined before any ulceration have taken place, there is found a hard, firm, incompressible substance which, cut into thin layers, is semitransparent, has the consistence of cartilage and fibro-cartilage to that of lard, with which appearances it in general agrees, and is composed of two different substances; the one hard and fibrous, the other soft and seemingly inorganized. The fibrous part forms without regularity various partitions and cavities, in which is contained a soft substance, having usually a pale brownish, sometimes bluish, greenish, whitish, or reddish colour, similar to hardened *albumen*. The fibrous part has sometimes a cartilaginous hardness. But specially are the proportions of these two substances very different; sometimes the fibrous substance forms as it were the *nucleus*, from which the partitions spread in every direction, and on the substance being cut, a radiated appearance is presented. Sometimes the whole swelling forms an homogeneous hard lard-like substance, in which no definite tissue can be discovered. Between these two extremes there are various links, merely distinguished by the different proportions of the two substances. Sometimes encysted tumours filled with fluids of different colours are found in a *scirrhus*. The *scirrhus* specially exists either as a tissue different from the organ in which it is developed, or from the conversion of the substance of the organ itself; in the latter case, the boundary between health and disease cannot be accurately determined.

If the tumour be examined in the state of concealed cancer, the lard-like substance is found harder in the centre than at the circumference; here and there it is spotted with red; rough and uneven at some parts, with cells of different size which are filled with a viscid, ash-gray, bloody fluid, of a very acrid nature. The edges of these cells which are found in the interspaces of the fibrous streaks are pale-red, and their inner walls covered with a soft and fungous substance; from which last may be here and there separated, by scratching with the finger-nail, little portions of the hard-white matter lying beneath (*a*).

Microscopic examination presents the following as elements of *scirrhus*.

(*a*) Scarpa, above cited, p. 29.

First, *cells* of very great variety in different cases; simple cell-*nuclei* with nuclear corpuscles, sometimes surrounded with very pale cells, sometimes with completely formed cells, in general rounded, sometimes studded with granules, or having granular contents. Tailed cells are rare, and when existing, seem rather dependent on the development of the fibres. Sometimes there are very characteristic cells, with very thick double walls and granular contents. Granules and fat-corpuscles are frequently mixed together with the cells, sometimes singly, sometimes collected in heaps, and sometimes as it appears enclosed in cells. Second, *fibres*, sometimes broad and band-like, sometimes narrow, and not unfrequently elastic fibres. The arrangement of the fibres varies considerably. Third, together with the cells and fibres there is commonly found as an actual element of *scirrhus*, a *mucous fluid*, which coagulates with acetic acid and solution of alum.

Müller (*a*) distinguishes four several kinds of *Carcinoma*, according to the different nature of the tissue. First, *Carcinoma simplex;* second, *Carcinoma reticulare;* third *Carcinoma alveolare*; and, fourth, *Carcinoma fasciculatum.* Therewith he also reckons *Carcinoma medullare* and *melanodes.*

In *Carcinoma simplex* and *fibrosum,* the uneven, generally lobeless substance which resists the knife, presents when cut through, a gray basal mass, which seems only remotely similar to cartilage, and in which there are irregular whitish bands. *Scirrhus* of the breast sometimes exhibits here and there white threads, in which a space can be perceived, and in it some colourless, whitish, or yellowish contents. It seems to originate in the thickening of the walls of the milk canals and lymphatic vessels. In *scirrhus* of nonglandular organs, no such hollow white theads are observed. The substance consists of a fibrous and of a granular gray substance. The former rarely appears distinct when cut through, but is seen on scraping off the gray matter, for which it is also the bed and presents a very irregular mesh-like tissue of bundles of tough fibres. The gray substance is composed entirely of microscopic formative corpuscles, which have little connexion with each other, are transparent and hollow cells or vesicles, with a diameter of from 0,00045–0,00120 of a Paris inch in diameter, and are soluble in neither cold nor boiling water nor acetic acid. In many of these cells may be distinguished merely some small spots, having the appearance of little granules; in others, a larger corpuscle, like a *nucleus,* or little vesicle contained in the cell-corpuscle. Besides the formative corpuscles, many little knobs of fat are always found scattered in the scirrhous substance.

Carcinoma reticulare when cut through is distinguished from *Carcinoma simplex* by he white reticulated figures distinguishable with the naked eye, which run through the gray substance, and by its tendency to form lobes as well also as by the greater bulk which it acquires. In consistence it sometimes resembles *scirrhus,* sometimes is softer and approaches medullary *fungus;* but with this variety of consistence, the structure always remains the same. It is composed of a gray globular basal substance, embedded n a mesh-like tissue of bundles of fibres, first observed by scraping, or by getting rid of the gray granular substance by maceration. The latter consists of similar transparent formative corpuscles or cell-corpuscles to those of *Carcinoma simplex,* which contain one, wo, or several little vesicles with pale *nuclei.* In other cases, the little nuclear cells annot be distinguished within the large formative corpuscles; on the contrary, many ittle granules are seen in the interior of the transparent cell-corpuscles, and such also are ometimes observed in large quantities loose between the vesicles, the smallest exhibiting molecular movement. Characteristic are the white or yellowish-white reticulated figures, more or less distinct but never deficient, which have no expanded little vessels with hickened walls, but are peculiar formations, and consisting of a deposition of white granules in the gray substance. They do not appear to be cellular, but seem for the most part a conglomeration of opaque granules of roundish and oblong corpuscles, which re two, three, or four times as large as the blood corpuscles. These white corpuscles ollect more and more during the progress of development, and form an element of he self-destroying tissue, sometimes whole pieces which are enclosed by the other subtance or line, the interior of the existing cells from whence they detach themselves ike a film. The corpuscles thence pass into the softening and suppuration of the broken

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(*a*) Above cited, p. 11.

up surface. With further development the reticulated figures readily flow into irregular white spots; their appearance then has some resemblance to the first appearance of white tubercles in the gray basal substance.

Carcinoma alveolare exhibits an irregular knobby surface, and as the base of the substance, a tissue of endless, crossing, very firm, white fibres and plates, between which simple cells are found, from the size of grains of sand to that of the largest peas, which are closed, but frequently communicate with the neighbouring cells, and all contain a very viscid pale, very transparent jelly. Under the microscope the little cells are seen to enclose still smaller cells, and these again contain still less. On the little cells the dusky-yellowish *nucleus* of its wall is plainly seen. Many cells also contain simple *nuclei* loose in their interior. The large cells are distinctly fibrous in their walls, and the fibres pass from one cell to another.

Carcinoma fasciculatum is distinguished by its throughout fibrous structure, which may be seen either by breaking or cutting through it. The tumour may be easily torn in the direction of the fibres, is not thereby crumbled, and under the microscope shows neither the cell globules of other *carcinomata*, nor the tailed bodies of the seemingly fibrous medullary *fungus*. The arrangement of the fibres is either tuft-like, and then the fibres can be torn into simple radical bundles, of which the points are directed towards the bottom and their base towards the irregular surface, or the bundles form different sets of fibrous expansions. Whole masses of fibres form one tuft, others different tufts. The large bundles of fibres thrust through each other, as is seen on tearing them asunder. In this case the swelling readily forms large and small lobes upon the surface and even in the interior. Between the lobes membranous partitions pass, to which the tufts of the fibrous substance are attached. Sometimes it is seen how the fibrous substance arises on a membranous surface, protrudes like a sheaf, then forms an arch above and again attaches itself to another membranous wall. These lobular throughout fibrous tumours often acquire considerable size. But the lobular form may be entirely wanting, and the whole swelling consist of a single tuft of radically arranged fibres. These swellings are very vascular, and the vessels have a straight course similar to the fibres. The substance of the swelling is sometimes transparent like jelly. The fibres are throughout pale and transparent; their surface is here and there beset as if tinctured with *nuclei*.

[Dr. Hodgkin (*a*) considers scirrhous to originate, like other malignant growths, from cysts, either of a simple or compound character, and has given the following excellent account of their development and progress:—

"Scirrhous tumours have a more or less rounded form. On making the section of them they present various appearances, but are all more or less divided by *septa*, which affect sometimes a radiated form, and at others a cellular character. Both of these characters have been insisted on by many writers on this subject; but I believe the differences which have been observed in many instances depended on the direction in which the sections were made. * * * If we carefully dissect down to the surface of one of these tumours, we shall usually find that it has a capsule or covering, which has, I believe, generally been supposed to consist of the altered and condensed cellular membrane of the parts which have given way before the growth of the tumour. This idea is probably correct with respect to the unequally thick external part of the capsule; but if we dissect carefully, and examine those tumours in which the progress of decay has either not commenced, or has made very little progress, we shall find that surface which is next to the mass of the tumour more or less smooth and even, and on raising it we find that it is reflected over one or more pyriform bodies, attached by a base, which is generally narrow or peduncular, to some part of the circumference of the enclosing capsule. Unless the tumour is very small, it is much more common to find several rather than a single body of this kind, and as there is often little, if any, fluid intervening between them and the enclosing capsule, their form is somewhat modified by their mutual pressure. Sometimes, though more or less closely applied to each other, these pedunculated bodies are perfectly detached at their sides, and may, consequently, be readily traced to the point which forms the common origin of their peduncles. At other times these bodies are so adherent amongst themselves, and the membrane covering them is so tender and delicate, that without very great care the arrangement of their structure may be overlooked, in consequence of the pedunculated bodies being broken or torn through in a different direction from that to which their mode of formation would naturally dispose them. It must be sufficiently obvious that the appearance presented by the section of a tumour, such as I have just described, must be very materially affected by the direction in which the section is made. If it pass through or near

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(*a*) Above cited.

to the point at which the pyriform bodies are attached to the enclosing cyst, it must nearly correspond with the direction which some of these bodies take towards the circumference, and these edges will consequently be seen in the form of radiating lines. On the other hand, if the section be made more or less nearly transversely to the axes of these bodies, their section will convey the idea of cells of various shapes. If we continue dissecting and raising the outer cyst, forming the reflected membrane which covers the radiating pedunculated bodies, we shall generally find that on one or more sides it dips down deeply into the mass of the tumour, and forms a part of the *septum* which separates the one packet of pedunculated bodies from the others, which generally concur to form the mass of the tumour; for it comparatively rarely happens that the tumour is composed of a single cyst filled with pedunculated bodies. On examining the different encysted packets of pedunculated bodies which compose the tumour, we shall often find some indication of their having taken their origin from nearly the same spot, which is generally the most indurated part of the tumour. We may likewise observe that the different secondary tumours, or encysted bundles of pedunculated bodies, are in very different stages of progress. In those in which the internal growth is most active, we shall find that a process has taken place perfectly similar to that which I described as occurring in ovarian tumours when the development of the contained cysts produced the *hernia* or rupture of the containing one. The secondary cyst or cysts, which make their way through the containing one, rapidly advance when they are free from the restraint which its pressure afforded, and thus constitute another tumour, which adds to the original mass. If we examine the structure of this new tumour, we shall find that the subordinate growths of which it is composed, radiate from the point at which this tumour made its escape from the original one. At the same time that the escaped cyst or cysts acquire their more rapid growth, they often acquire a new character with respect to their consistence, which is generally much more soft and tender. * * * Those parts of the tumours in which the rapid and unrestrained growth is most remarkable, are generally situated near the circumference, where they are at once both exempt from the restraint of mutual pressure, and receive more abundant supply of nourishment from the surrounding natural structures. A marked difference exists between those just described, and others in which development has been restrained, or vitality lost by pressure, and consequent defective supply of nutrient matter. I have already explained the mode in which these effects are brought about in those ovarian tumours in which the secondary cysts are thickly crowded and attached by very narrow peduncles. Precisely the same process takes place in the tumours of which I am now speaking; and when we make a section through one of them, which happens to be composed of many secondary tumours, and which consequently presents many centres of radiation, we shall often find that the penduculated bodies connected with one or more of these centres have lost their vitality by a natural strangulation or ligature, and also that the immediately adjoining parts which yet retain their vitality, irritated by that which has now acquired the character of a foreign body, are brought into a state of inflammation. The result of this compound action is the formation of a cavity filled with broken down and softened matter of a peculiar character, intermediate between suppuration and gangrene. This process very frequently takes place before the exterior of the tumours exhibits any symptom of irritation or inflammation, and to my mind, very satisfactorily accounts for that disposition to central softening and decay, on which LAENNEC, WARDROP, and some others, have so forcibly insisted as characterizing the progress of heterologue deposits. At the same time, I think I am correct in stating, that for the production of this form of gangrene or softening, the supply of nourishment should be pretty promptly cut off by the operation of the natural ligature. When the process proceeds more slowly, the parts which are under its influence gradually acquire an increasingly dense structure, and ultimately becoming penetrated by earthy matter, are allowed to remain unproductive of serious irritation, notwithstanding their deteriorated organization and diminished supply of nourishment. * * * Such tumours in the course of their development produce, by the irritation which they excite, a greater or less degree of thickening of the surrounding cellular structure, and sooner or later become visible externally, dilating the integuments which are stretched over them. The points at which this distension is the most considerable are inflamed, the inflammation proceeds to ulceration, and the tumour either sprouts luxuriantly at the part from which the pressure is thus removed, or participates in the ulcerative process.

"The ulcer is universally described as presenting elevated and everted edges, while its ragged and depressed central portion is bathed by an unhealthy secretion, to which the name of pus can scarcely be applied. The mechanism by which this peculiar ulcer is produced, is well worthy of attention. I have shown that at the external part of the tumour its growth is most luxuriant, both from the want of pressure, and from the increased supply of nourishment. This will explain why the circumference of the tumour is the most elevated. The central parts, on the other hand, have not only to encounter the pressure which they sustain from the surrounding parts of the tumour, and to suffer the diminished supply of nourishment which this pressure occasions, but moreover, ulceration having removed the integuments, all supply of nourishment from the surrounding natural structures is necessarily cut off. The depth and irregularity of the central part of the ulcer is often further promoted by a communication being formed between this part of the ulcer and a cavity commenced and produced on the interior of the tumour by the process heretofore described." (p. 294–302)].

"True scirrhous tumours," HODGKIN further remarks, "appear sometimes to depend on a single primary tumour; at other times, several may be satisfactorily made out. That part of the tumour which appears to have been the common origin of the primary cysts, where there are more than one, or from which the contained pedunculated bodies radiate, when there is only a single primary tumour, is, in general, the most indurated portion, and is, at the same time, the most indistinct in its structure. When examined externally, after the surrounding natural structures have been carefully dissected off, this part of the tumour is found to be the most irregular, has a somewhat corrugated appearance, and suggests the idea of its having been the sort of root by which the adventitious growth was implanted on the natural structures. The radiated appearance so strongly insisted on by most authors who have described scirrhous tumours, and the rationale of which I trust I have shown, is particularly conspicuous when the section passes through this point. The fluid part of a true scirrhous tumour bears in general a very small proportion to the rest of the structure, it has a viscous or mucous character, more especially where softening has not taken place; but where this is going on it assumes the character of an offensive ichorous discharge, and acrid and highly deleterious qualities have by some been ascribed to it. The process of softening sometimes commences internally at one point, at other times in several small isolated points; in others, again, the ulceration through the integuments is the first part of the process of decay." (p. 323–25.)]

2396. The secondary development of cancerous ulceration may occur from venereal, herpetic, scrofulous, and other sores, as well also as from different kinds of growths, *condylomata*, warts, and polyps, which are not originally carcinomatous, but by irritating treatment and the like, pass into a scirrhous condition.

2397. Cancer does not appear to be primarily developed in all tissues; at least, the muscles of locomotion, the serous membranes, cartilage, and tendon, are not originally attacked by it. The skin, the cellular tissue, the secerning and lymphatic glands, the mucous membranes; the nerves and bones appear to be the only tissues capable of an original development of cancer. This disease also arises more frequently in some organs than others; it is most commonly seen in the gland of the breast, in the testicle, on the womb, on the lips, the tongue, the eye, on the *penis*, the *clitoris*, and the like. The spreading of the disease to the neighbouring parts appears also proportional to their nature; the cellular tissue and skin covering the tumour are first attacked and destroyed, even before the tumour adheres to the underlying muscles, as for instance, in cancer of the breast. The serous membranes only become attacked at a later period. The bones for a long while withstand the destruction; however, they are eaten into and at last destroyed, as well, indeed, as the vessels which are attacked latest, though, however, yielding to destruction, as the often occurring bleedings prove. When the disease has been still longer protracted, the lymphatic glands which are in relation to the original *scirrhus* become affected; sometimes this happens even at the onset, sometimes only in the latter stage of the disease.

WALTHER (*a*) has disproved by cases, SCARPA's assertion, that true *scirrhus* never occurs primarily in a lymphatic gland.

(*a*) Above cited, p. 202.

2398. The symptoms which cancer presents in its origin and course are very different, and seem to depend on the difference of constitution, of the mischief producing it, and of the tissue attacked by it, as has been already noticed in the special consideration of the subject, although a definite causal relation in this respect cannot always be determined.

Cancer is often excessively destructive, and eating, surrounded with hard edges, and sometimes accompanied with fungous growths. The former kind seems to be peculiar rather to old persons, to sanguineous and choleric temperaments; whilst the latter occurs in young persons and phlegmatic constitutions. Sometimes the course of the cancer is extremely quick, a large strip of the skin is suddenly destroyed, and the greater part of the cancerous swelling bursts through the turning out of the edges of the skin. In other cases the course of the cancer is tedious, the ulceration seems determined after the bursting of the swelling; the edges of the skin turn inwards, the discharge of *ichor* is slight, and the disease may have long existed before it spreads. The mischievous influence of cancer upon the constitution also varies according to its seat in different organs. The general symptoms of cancerous dyscrasy often set in early, before softening and ulceration; often it appears when there has been already farspreading destruction of the scirrhous part.

Alibert (*a*) has laid down six different kinds of cancer; first, *Cancer fungoides*, common cancer; second, *Cancer terebrans*, cancer of the skin; third, *Cancer eburneus*, hard like ivory; fourth, *Cancer globosus*, presenting a roundish swelling, usually painless, of a violet or blackish colour, and generally, not confined to one spot, but affecting large streaks on the head, feet, and so on; fifth, *Cancer anthracinus*, arising with a black spot in the skin, accompanied with a painful itching, and, as it enlarges, a mulberry-like excrescence rises out of it; sixth, *Cancer melaeneus, tuberosus*, taking its origin from the knobs which are developed more or less numerously, and of different size in the cellular tissue.

2399. The *diagnosis* of scirrhous tumours is frequently accompanied with difficulty. When the skin covering the swelling is puckered, has a dark-leaden colour, a knotty and irregular surface; when sometimes there is lancinating pain in the tumour, and it is firmly attached to the neighbouring parts, there can indeed be no doubt of the scirrhous nature of the swelling. But the hardness and condition of the surface of *scirrhus* often varies, and may be equally present in swellings of other kind. In many instances *scirrhus* is movable, not connected with the underlying parts, painless, and the skin often not at all altered. The disposition of *scirrhus* to run into cancer, usually given as a mark of distinction from benignant induration, cannot be decided beforehand; this transition is not even necessary thereto, and not unfrequently depends on accidental influences, to which the tumour is subjected. *Scirrhus* does not, in general, easily acquire that size which other swellings do; and the latter do not readily acquire the same heaviness, nor have they the disposition to draw the neighbouring parts into the same diseased metamorphosis. Examination of the swelling after removal gives a distinct explanation of its nature, as does also the recurrence of a like tumour after removal, which, indeed, is then only of importance as to the *prognosis*. The cancerous sore itself has no such decided and characteristic mark that a mistake may not sometimes be possible with much neglected syphilitic or scrofulous ulcers, as these, oftentimes, without being actually cancerous, present the same symptoms as cancerous sores. In these cases, the improvement or injury effected by

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(*a*) Nosologie Naturelle.

anti-syphilitic or anti-scrofulous treatment, as well also, as the circumstance, that in cancerous sores, the pain is alone diminished by softening and soothing remedies, but increased by all irritants, will direct the practitioner.

Scarpa (*a*), who commonly applies the term *scrofulous* or *strumous* tumour to a great extent, and also refers to cases which must manifestly be reckoned with medullary *fungus*, states the following, as distinguishing characters between it and *scirrhus*. *Scrofula* rarely attacks the external conglomerated, but usually the lymphatic glands, and in general, several of them at the same time, and in different parts of the body; there may be also an existing scrofulous habit. The hardness of the scrofulous tumour is regular and flat, and different from the peculiar hardness of *scirrhus*. The scrofulous tumour, from the first, produces a wearing, numbing, heavy pain. *Scirrhus* only attacks persons of advanced age, rigid fibre, and sanguineo-choleric temperament, in whom, if there be suspicion of a dyscrasy, it is not that of scrofula; *scirrhus* appears *alone*, grows slowly, and scarcely perceptibly in every direction, is not sensitive. and when long existent, has in general, knots on the surface, and is adherent to the skin in many places. When stabbing pains come on in *scirrhus*, it no longer increases, indeed, even contracts, with a hardness, from which it may be said, it is disposed to dryness. In injecting a strumous gland, the fluid at first passes freely, but suddenly runs out, because the vessels are torn. When cut through, such gland presents a compact very vascular substance, penetrated with albuminous fluid, which sometimes, though rarely, is mixed with a fatty, granular, or whey-like matter. Between the bodies of the strumous glands, and their external covering, some trace of coagulable lymph is always found, which favours adhesion; but this is also often in the interior. In *scirrhus*, the injection penetrates only into the principal arterial trunks. In maceration, the substance of *scirrhus* retains the peculiar hardness of softened cartilage, whilst strumous glands dissolve into a soft, fungous, fringy substance.

[The following are the diagnostic characters given by Hodgkin, of *scirrhus* and medullary *fungus*, or fungoid disease, as he calls the latter.

" One of the most striking features which distinguishes the fungoid disease from true *scirrhus*, is to be found in the extent and rapidity of the development of fungoid tumours. Whilst, as has been seen, the true *scirrhus* often remains for a considerable length of time in a chronic and indolent state, and after a growth of some years produces a tumour of only a moderate size, the fungoid tumour in the space of a few weeks is sometimes seen to attain to a prodigious size, and to pass through all the stages which belong to it in common with the other members of the same family of adventitious structures. Whilst true *scirrhus* is almost exclusively the disease of advanced life, the fungoid disease makes its appearance in individuals of every age; but its most formidable and extensive ravages are seen in the young. Whilst in true *scirrhus* the fluid matter forms a very inconsiderable and scarcely notable part of the structure, in the fungoid tumour it is frequently pretty abundant, presents a great variety in its characters, and is often collected in cavities of considerable size. In the scirrhous tumour, the peculiar mode of formation I have pointed out, must often be inferred by analogy, guided by faint and partial traces; but in the fungoid disease we meet with those unequivocal manifestations, which almost speak for themselves. In true *scirrhus*, the traces of vascularity are very faint, but in the fungoid disease, the adventitious membranes possess a higher and preternatural degree of vascularity. The vessels which we see ramifying in them, are not only numerous, but large. By some they have been considered principally arterial; by others venous. I will not attempt to decide to which class of vessels they are most allied. They appear to consist of the capillary vessels of Bichat on a large scale; and as we sometimes meet with these membranes of a bright and arterial red, and at other times of a venous or livid hue, it seems probable that accidental or fortuitous circumstances have the principal share in determining to which class of vessels these capillaries should most incline. These newly-formed vessels, though large and numerous, are extremely weak and tender, and derive little or no support from the structure through which they ramify, or by which they are surrounded; hence they are liable to give way at numerous points, whence proceed more frequent and extensive hæmorrhages which so often characterize these tumours, and have led to the term of *fungus hæmatodes*, which has not inaptly been applied to many of them. Sometimes the hæmorrhage from these vessels produces an effusion into the cavity of the membrane reflected over an inferior order of pedunculated cysts or bodies, and distends

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(*a*) Above cited.

it into a cavity filled with blood, the characters of which will vary according to the time which has elapsed between its effusion and the making of the examination. At other times the effused blood infiltrates the more solid parts of the tumour, and produces an appearance which by LAENNEC has been well compared to an apoplectic clot. The more solid parts of the tumour differ in a marked manner from that which composes the scirrhous tumour. In this disease, the secondary cysts, which are often of large size, generally become filled with a material which at first bears a considerable resemblance to tender or feebly coagulated fibrin or plastic lymph. Into this substance new vessels speedily shoot; but being neither susceptible of perfect organization, nor calculated to remain inert and dormant, it speedily, but gradually loses its vitality, and, like other transparent parts in which such a change is effected, gradually becomes opaque, and bears, in consistence and appearance, a close resemblance to the substance of the brain of a child; hence the terms, *cerebriform cancer*, *encephaloid tumour* and *medullary sarcoma*. * * * Although in fungoid disease, the solid part of the tumour often bears a striking resemblance to cerebral substance, we frequently find it, on the one hand, deviating into a much more firm material, and, on the other hand, into one of a softer and grumous consistence. Sometimes it has a minutely foliated structure of a pearly white colour. When the diseased structure has completely lost its vitality, it breaks down into a variously discoloured pultaceous grumous mass, in which the remains of the membranes of the secondary cysts and their vessels may often be detected. Although in a recently formed tumour, or in the newer parts of an older one, the traces of that mode of formation on which I have insisted are sufficiently evident, they are very much lost or obscured, as the progress of decay advances. It is also at times difficult to distinguish it when the tumour has only advanced to the stage of opacity, provided the substance of the tumour be very uniform, and the membranous parts not only very thin and tender, but adherent amongst themselves and to the contained substance." (p. 333-37.)

The following is the analysis of *scirrhus* by FOY (*a*):—

Albumen	42,00	Subphosphate of lime		16,60
White fatty matter	5,00	Carbonates of	soda	5,00
Red	3,25		lime	6,60
Osmazome	0,00		magnesia	0,85
Fibrin	5,85	Hydrochlorates of	potash	4,10
Water	5,00		soda	3,25
Oxide of iron	1,65	Tartrate of soda		0,85

Hence it appears by reference to the analysis of medullary *fungus* (p. 719) that *scirrhus* contains less of the first three substances, that it has no osmazome; that the subphosphate of lime is nearly three times as much; and that the total amount of the salts is double that in medullary *fungus*.]

2400. *Cancer in the skin* arises from true *scirrhus*, which appears as a round or oblong flattened firm swelling, also from warts and other excrescences of the skin, sometimes from dark red, blackish spots, or from scurfy excoriations. It may occur on all parts of the surface of the body, but especially in the face, on the nose, on the lips, and on the organs of generation, either on account of the peculiar sensibility of the skin on these parts, or because it is here so much affected by external influences. At first a superficial ulcer forms, which enlarges, becomes painful, and is not improved by any remedy. Its progress is sometimes slow, sometimes quick, and relative to the severity of the pain and the violence of the suppuration. These ulcers are long confined to one definite spot, and remain superficial; the surrounding skin is sometimes but little changed, its surface red and even, sometimes covered with a dry, grayish crust, which is reproduced as often as it is removed. As soon as these ulcers take effect on the edge of the lip, the nose, the eyelid, the *anus*, or the *urethra*, they make quick progress, increase in depth, destroy all parts without distinction of structure, and are characterized by their condition, by the lancinating pain, and by the infection of the neighbouring glands. Whilst the

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(*a*) Archives Générales de Médecine, vol. xvii. p. 185.

ulcers are still small, they are generally only made worse by common treatment. They are frequently found existing at the same time with external and internal cancerous disease.

Ulcers, specially on the face, and wings of the nose, and the like, which without pain, without a hard base, without everted hard edges, without fungous growths, without secretion of *ichor*, spread in all directions, and destroy the parts without distinction of their organization, without our knowing where they will go, have, in common with cancer, only the destructive spreading, and the general circumstance that they can ordinarily be brought to heal, only by destroying their surface. These are phagedenic ulcers, stinking, eating, tettery sores, and form a contrast with the scabby *Herpes exedens*, which on the face often causes the most frightful destruction, and in general can only be made to heal by destroying the diseased portion of skin.

2401. *Cancer in glands* always begins as *scirrhus*, and presents the symptoms above described (*par.* 2392.)

2402. *Cancer in mucous membranes* is developed either in form of polyps, which are hard, uneven, dusky, red, and painful; often bleed of themselves, or, on the slightest movement; ulcerate quickly; exhibit the same symptoms as a cancerous ulcer, and on examination, present the same condition as *scirrhus;* or, under the form of hard, wart-like excrescences, or as hardening of the mucous membrane, which runs into ulceration.

2403. *Cancer in the bones* shows itself as *osteosarcoma*, or *osteosteatoma;* and these tumours may have primarily a scirrhous condition, or the cancerous nature may be developed in them at a later period.

2404. *Cancer of the nerves* exists as a hard firm swelling, which internally shows its scirrhous nature, and seems to belong to the *neurilema* rather than to the medullary substance. Sometimes the tumour is seated on a stalk with which the *neurilema* is confluent; sometimes it is formed by the swelling of the nerve itself. Their size varies from that of a pea to that of a nut, and larger. These swellings arise sometimes of themselves, sometimes after external violence, most commonly on the superficial nerves of the upper limbs. They increase slowly, feel hardish, are tense, seem often filled with fluid; they are very painful, specially on motion, and particularly on being moved from above downwards; a sudden movement of the swelling in this direction produces on the brain and nervous system a sensation like that of an electric shock. The tumour adheres to the neighbouring parts, and draws them into the same diseased condition.

Not all tumours of nerves have this cancerous character. They are often mere consequences of previous inflammation, and originate in increased and altered nutrition; they are often formed by unnatural exudation, in which case examination shows a cavity, of which the walls are the *neurilema*, filled with thin, coagulable fluid, like the *serum* of the blood; or between the nervous threads, which are pressed apart, a softish, but constantly becoming firmer substance is formed; or in the nervous threads themselves, oblong vesicles are formed, which at first are soft and transparent, but afterwards become harder, and by their increasing size, affect the whole substance of the nerve, and the nerve above penetrates into the swelling, and below passes out of it. Their size varies from that of a pea to that of a nut, and bigger. I have seen a tumour in the lower third of the thigh, on the ischiatic nerve, as large as a small melon, which had proceeded from the nervous mass itself, and was covered with *neurilema*. The characteristic of these tumours is always great painfulness on examining and moving them with the finger; they however cause, especially when seated on large nerves, severe pain on moving the part, even without displacement, especially on voluntary motion. The pain is very severe, radiating in the course of the nerve, and frequently accompanied with cramp and convulsions of the part. Sometimes there is less pain than a sensation of formication, and going to sleep, or even a palsied state of the part to which the nerve is distributed.

The removal of the tumour is the only remedy; destructive remedies of all kinds are useless, and escharotics act injuriously. The removal consists in laying bare the swelling, and where it protrudes from the nerve, and is separable from it, in cutting it off. If this be not possible, or the tumour spring from the nerve itself, then the nerve must be cut through, *first above*, and then below the tumour, and the intermediate portion, together with the swelling, removed. Small swellings on the nerves of the skin may be taken away with the corresponding piece of skin. In large tumours of principal nerves, as in the case of the ischiatic nerve which I have mentioned, amputation is the only remedy.

[I am doubtful whether the following cases mentioned by Cheselden (*a*) be tumours on the small branches of nerves; but the symptoms scarcely permit them to be considered any other:—"Immediately under the skin, upon the shin-bone, I have twice seen," says he, "little tumours, less than a pea, round and exceeding hard, and so painful that both cases were judged to be cancerous; they were cured by extirpating the tumour. But what was more extraordinary was a tumour of this kind under the skin of the buttock, small as a pin's head, yet so painful that the least touch was insupportable, and the skin for half an inch round was emaciated; this, too, I extirpated, with so much of the skin as was emaciated, and some fat. The patient, who before the operation could not endure to set his leg to the ground, nor turn on his bed without exquisite pain, grew immediately easy, walked to his bed without any complaint, and was soon cured." (p. 136.)

There is in the Museum at St. Thomas's a fine example of a tumour in the popliteal nerve of a man, which caused such severe pain and tenderness, with occasional spasm, in the limb, that amputation was performed by Astley Cooper. The tumour is about the size of a walnut, whitish and hard, and of a somewhat scirrhous character; it seemed to have formed amid the cords of the nerve, which do not appear to enter it, but are expanded over its surface.

Liston (*b*) observes, that "these tumours (of nerves) vary in structure; they consist of a cheesy or albuminous deposit in the *neurilema*; sometimes they are hard, fibrinous, or earthy, or again, their section presents a brainlike and bloody mixture." And he mentions a case in which the tumour, soft and bloody, was situated "in the popliteal space, grew rapidly to the size of a cricket-ball, and impeded the motions of the limb. On pursuing the dissection, the tibial nerve was found intimately connected with the growth, the *fibrillæ* stretched upon its sheath, and entering into its substance. The nerve was cut across above and below, and the whole mass extirpated unbroken and entire. * * * The removal of the tumour from the ham, with at least three inches of the tibial nerve, was not for an instant followed by the slightest deprivation of either sensation or power of motion in the limb and foot." Whilst in the hospital, a tumour was found on the front of the same thigh; an inflammatory swelling took place there and suppurated, but the lump remained. "Within six months after the wound in the ham had healed, the patient returned with an enormously swollen limb, and a large elastic morbid mass in the back part of it; from this a bleeding *fungus* was protruded, and he soon died. The original tumour was soft and bloody; the one from the fore part of the thigh ovoid and larger than a hen's egg, involved the anterior crural nerve, and was apparently fibrinous; the diseased structure, which was reproduced in the popliteal space, had all the characters of *fungus hæmatodes*." (pp. 350, 351.) Tumours not malignant have been occasionally removed from nerves with success.

It will be here convenient to notice the formation of *Tumours on the extremities of the nerves of stumps*, which occasionally, though rarely, occur, and I do not recollect to have seen more than two or three such cases. At an indefinite period after amputation, either before or after it has healed, the stump begins, without any apparent cause, to become painful, and though it had previously been well shaped, it now begins to assume a conical form, the soft parts retract, the bone sticks out covered only by the scar, which is generally a little inflamed, and the skin above it is extremely tender and painful, when touched. Langstaff (*c*) in noticing this condition, says:—"Sometimes, a spiculum of bone projects horizontally, generally taking the direction of the artery, vein, and nerves of the limb, which thus become implicated with the bony deposit; and sometimes I have found a large spiculum of bone, with a very sharp point, taking an oblique direction, and connected with a muscle, occasioning morbid changes in its fibres, and being a source of great suffering to the patient. In all such stumps I have found the nerves greatly enlarged at their extremities, giving them a ganglionic appearance, and generally firmly adherent to the surface of the stump, and frequently in union with spicula of bone." (p. 131). In the two cases which I have had the opportunity of

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(*a*) The Anatomy of the Human Body. 8vo. Eleventh Edition, 1778.

(*b*) Practical Surgery. Fourth Edition, 1846.

(*c*) Med.-Chir. Trans., vol. xvi.

dissecting, there was certainly no bony spiculum irritating the nerve, and there did not appear any satisfactory reason why its enlargement should have taken place. The tumours seemed to be caused by interstitial deposit of fibrinous matter among the fibrils of the nerves, which were principally spread out on their surface. **Astley Cooper** amputated his case at the shoulder-joint, and there was no recurrence of the symptoms. **Henry Cline** thought that the retraction of the stump depended on the irritation of the diseased ends of the nerves, and that if these were removed, amputation would not be needed. He, therefore, cut through the skin over the swellings, also through the nervous trunks above them, and left the bone and other parts undisturbed. The result proved the justness of his opinion. There was no recurrence of swelling of the nerves, nor pain, and the stump gradually filled out, ceased to be conical, and resumed the ordinary appearance. From comparison of these two modes of practice, I should not think it warrantable to perform a second amputation at any distance above the stump; I should be inclined to follow **Henry Cline**'s method; and if there were reason to think this could not be satisfactorily managed, I should merely amputate so high above the nervous tumours as would appear necessary to ensure cutting through the healthy nerve. I have an indistinct remembrance that **Tyrrell** pursued the latter practice in one instance successfully, but I have not any note of it, so that I mention it with doubt.

Sometimes, however, neither of these methods are of any permanent service, as the painful affection of the nerves is not confined to their extremities. A remarkable case of this kind is mentioned by **Mayo** (*a*), in which, on account of this condition, amputation was performed a second time. "On examination, the sciatic nerve and the saphenous nerve were found to terminate in large callous bulbs. In the second operation, care was taken to draw out and remove a considerable portion of the sciatic nerve, which, retracting, lay well covered among the muscles. Nevertheless, when the stump had nearly healed, the old pain again commenced." (p. 140.) He afterwards cut down on the sciatic nerve, where covered by the lower edge of the *m. glutæus maximus*, divided and removed a portion of it, but with only temporary benefit. He thought that amputation at the hip-joint might possibly have cured this, as amputation at the shoulder-joint had put an end to a similar neuralgia in the fore-arm, which had been unsuccessfully amputated a second time. I must confess I should feel little disposed to perform a third amputation in a case of this kind.—J. F. S.]

The following writers may be consulted on tumours of the nerves:—

Viel-Hautmernil, Considérations générales sur le Cancer. Paris, 1807.

Alexander, Dissert. de Tumoribus Nervorum. Ludg. Bat., 1810.

Spangenberg, Ueber Nervenanschwellungen; in **Horn**'s Archiv., vol. v. p. 306.

Neumann, Geschichte einer Nervenanschwellung; in **von Siebold**'s Sammlung seltener chirurg. Beobacht., vol. i. p. 54.

Weinhold, Ideen über die abnorme Metamorphosen der Highmorshöhle, p. 184.

Aronsohn, J. L., Observations sur les Tumeurs développées dans les Nerfs.; avec fig. col. Strasbourg, 1822. 4to.

Chelius; in Heidlb. klinisch. Annalen, vol. ii.

Wood, William, Observations on Neuroma, with cases, &c.; in Transact. of the Med.-Chir. of Edinburgh, vol. iii. p. 367.

Baumeister, Dissert. de Tumoribus Nervorum. Bonnæ, 1833.

Hasler, Dissert. de Neuromate. Turici, 1835.

Struck, Dissert. sistens observationem Fungi medullaris Nervi mediani. Gryphiæ, 1836.

Knoblauch, A., Dissert. de Neuromate, et gangliis accessoriis veris adjecto cujusvis casu novo atque insigni. Francof. ad M., 1843.

2405. Cancer is a disease of specific character, depending on a peculiar *disposition*, the nature of which is entirely unknown; it may be asserted to be hereditary, in different degrees, in one and the same person, and at different periods. This disposition is the cause why the treatment of cancer is ordinarily without benefit, why the disease appears in several parts at once, and why even the early removal of scirrhous swelling is

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(*a*) Outlines of Human Pathology. London, 1827. 8vo.

usually unsuccessful. In the progress of the disease a peculiar *dyscrasy* (*par.* 2394) is set up by the absorption of the matter produced in the diseased organ.

Opinions upon the causal nature of cancer are different. Some denying a peculiar disposition, consider cancer to be a local complaint, which only produces a decided dyscrasy from its spreading. Others allow no specific nature in cancer, some hold it infectious, others not. Even the assumption of a specific dyscrasy arising out of cancerous parts is denied, because the neighbouring glands often swell, before the *scirrhus* is disposed to ulcerate; because, further, the glands often even when the disease has long existed, are not attacked, and the experiments of the capability of the poison of cancer to infect contradict this assumption (*a*). Many deny the absorption of the cancerous ichor, and a dyscrasy depending on it (*b*), whilst LANGENBECK (*c*) showed microscopically the presence of cancerous matter in the veins, and after injecting into the veins of a dog found tumours in the lungs, the cancerous nature of which was shown by microscopic examination.

The swelling of the neighbouring glands may indeed be also produced by pressure, and by the propagated irritation. Relapses of the disease after removal commonly depend on what has been left behind. In those cases, however, where the scar has been for many years, till the disease again breaks out, it is more probable that the cause of its recurrence is a decided predisposition (1).

[(1) Upon this point JOHN HUNTER (*d*) observes:—"Some suppose cancers to be hereditary; but this I can only admit according to my principles of hereditary right; that is, supposing a person to possess a strong disposition or susceptibility for a particular disease, the children may also; but I have not yet ascertained the generality of this fact. In many persons it would seem that some of the predisposing causes are sufficient to become the immediate ones; as when the diseased action takes place at a certain stated time, without any immediate cause." (p. 623.)]

2406. The *occasional causes* of *scirrhus* and cancer are, all mischief which produces a constant but not intense irritation, blows, continual pressure, bruises; irritating treatment, or any injury of an ulcer, a hardness or an excrescence; internal diseases, especially scrofula and *syphilis*, as the consequent swellings and affections may assume a scirrhous character. Cancer is most frequent at the critical periods of life, when the capability of production declines, and especially in organs destined for production and propagation, as the womb, testicle, and breast. Women are more subject to it than men; in like manner, also, persons who are very sensitive or melancholic, lead a sedentary life, and have suffered much care and trouble (1).

[(1) "The cancerous age," says JOHN HUNTER, "is from forty to sixty in both sexes, though it may occur sooner or later in certain cases. The testicle for instance often becomes cancerous at twenty or thirty, but then not from the disposition of the parts alone, but from accident. * * * We often see tumours in the breast at thirty, and probably some of them are cancerous, although scrofula is more to be suspected." (p. 622.) He further observes:—"The parts most disposed to cancer are those peculiar to the sexes, as the breasts and *uterus* in women, and the testicles in men. Cancers are more frequent in women than in men, in the proportion of three to two; owing, perhaps, to the more frequent changes taking place in these parts in the former. It is that change which renders them unfit for conception, and changes the whole system, which is particularly obnoxious. Thus the three disposing causes are: *first*, a peculiar part; *second*, the age of the patient; and *third*, the peculiarities of the part at this age." (p. 623.)]

2407. The *prognosis* in *scirrhus* and cancer is always unfavourable, and proportionally so according to the importance of the organ affected, the bad constitution of the patient, when there is hereditary disposition, when the symptoms accompanying cancer are very painful and destructive, and when general dyscrasy has set in. The more superficially the *scirrhus* or

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(*a*) ALIBERT, above cited, p. 558.

(*b*) STEFFANI; in Revue Médicale. 1844; vol. ii. p. 351.

(*c*) SCHMIDT's Jahrbucher, vol. xxv. part i.

(*d*) Lectures; in his Works by PALMER, vol. i.

cancer is seated, the less hereditary the disposition or general disease accompanying it, the more it is the consequence of local disease, the better the constitution, and the more recent the disease, the more favourable is the prognosis. When several cancerous ulcers or *scirrhi* exist at the same time, and the cancerous dyscrasy has already affected the whole body, the disease is, according to my present experience, incurable.

Scarpa assumes that *scirrhus* in its first period is merely a deposited, malignant kind of germ, which is produced in the constitution, but is developed by the living powers, and is *most intimately* connected with any one of the conglomerate glands, or upon any one part of either the external or internal skin, where it is concealed and remains latent; but that in cancer, the hitherto harmless and latent deposit is converted into a cancerous *ichor*, and produces general dyscrasy. He supposes also that the removal of the *scirrhus* whilst in its painless state can alone have a successful result.

[Travers has most justly observed, that "not unfrequently the scirrhous tumour is perfectly inert from the period of its formation to the close of life, undergoing very slight, if any, increase, and giving, when mental apprehension is appeased, no trouble to the subject of it. A lady under his observation had been many years so situated, enjoying uninterrupted health, though considerably above seventy years of age." (p. 214.) Brodie (*a*) mentions one case in which the patient had scirrhous disease of the breast for several years, he believes ten or fifteen; and another, "who had a scirrhous tumour of the breast twenty-five years, and she died at last, not from the disease of the breast, but from effusion into the cavity of the chest." (p. 211.) Such cases, I suspect, are more frequent than generally believed. I have known a few instances, one of which indeed was in a relative, who suffered only occasional slight shooting in the breast, for at least twenty years, during which the tumour did not increase in size after its early growth to the size of a walnut. So long, therefore, as the disease remains in this quiet condition, I am disposed to believe that it is best left alone; for scarcely any, if indeed any, treatment has other effect than exciting an increase of the diseased action, and hurrying on the fatal result. Very few Surgeons have any reliance in the employment of internal and external remedies for the cure of cancer, even when in the scirrhous state; and the large experience of those who, in the course of operating practice, have extirpated cancerous tumours in their several stages, has been most lamentably unsatisfactory, the disease speedily recurring in the scar of the operation-wound, and the patient often quickly cut off.—J. F. S.]

2408. The *cure* of *scirrhus* and cancer requires either the dispersion of the tumour by internal and external remedies, or its removal by the knife or escharotics.

[Leroy d'Étiolles (*b*) has given the following interesting facts relative to the treatment of cancer:—"The mean duration of the life of persons not operated on is five years for men, and five years and six months for women; whilst, on the contrary, with those who have undergone the operation, the mean is five years and two months for men, and six years for women. It must, however, be borne in mind, that the class of those not operated on includes cancer of the *viscera*, which is so certainly and promptly, for the most part, fatal. By withdrawing these, the mean duration of men not operated on is six years, or one year more than in those upon whom the operation has been performed. If, however, it be inquired, what time elapses between the appearance of the disease on the one hand, and on the other, between the operation and death, on taking the mean of the results of three hundred operations on men, the duration of life will be found to have been *three years and nine months before*, and *one year and five months after the operation.* For women, the result of four hundred and twelve operations, gives, *before the operation, three years and six months; after the operation, two years and six months.* Extirpation does not, therefore, prolong life. (pp. 454, 55.) Of eight hundred and one cases operated on, one hundred and seventeen were performed in less than a year after the appearance of the disease; of these one hundred and seventeen there are sixty-one which have returned; but as of the number eight hundred and one operations, one hundred and twelve had been performed within less than a year, at the time when I received the observations of the physicians, we must believe that the proportion is at the present time still greater. If, however, we examine the results of operations per-

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(*a*) Lectures illustrative of various subjects in Pathology and Surgery. London, 1846.

(*b*) Bulletin de l'Académie Royale de Médecine, vol. ix. 1843-44.

formed many years after the appearance of the disease, that is, at a period in which it was capable of producing its degeneration, we find among the operations not followed by return, there are fifty-two performed more than five years after the development of the disease. * * * In spite of the transformation in similar tissues attacked by the cancerous affection, there are immense differences as to its termination. The lips afford the proof. Of six hundred and thirty-three men affected with cancer, one hundred and sixty-five were attacked in the lip, that is $\frac{26}{100}$. Of two thousand one hundred and forty-eight cancerous women, there were only fifty-four cancers of the lip, one and half hundredth. Of one hundred and sixty-five men, one hundred and eleven were operated on with cutting instruments, twelve by caustic. Of the one hundred and fourteen operations there were fifteen returns, or about one-eighth, when the documents reached me. Of thirty-four lips of women, twenty two were operated on, and one of them with caustic, seven returned, or one-third. The difference in the frequency of the disease must evidently be referred to the use of the pipe, and especially those called *brûle-gueule*, (*dudeen* of the Irish,) which workmen and men of that class constantly use. This difference of the cause accounts for the difference of the results. The return of the disease in men is less in proportion, because the greater number of cancroid diseases of the lip produced and kept up by an external cause are not true cancers; and yet the symptoms, the characters of the disease do not make known its nature.

"Cancers in the tongue are also more frequent in men than in women; but the proportion of success we have just mentioned no longer exists here. In both sexes cancers of the tongue have a termination equally sad. Of six hundred and thirty-three cancers observed in men, eighteen had been developed on the tongue; of two thousand one hundred and forty-eight cancers in women, two only attacked that organ; nine operations were performed, three by caustic, six with the knife; eight men and only one woman. Of these nine operations, three were performed since less than a year; six died after its return.

"Of tumours of the breast we have the following results:—Of two hundred and seventy-seven operations, seventy-three were performed within less than two years; I cannot give the result. There remain two hundred and four. Of these two hundred and four, twenty-two died in the year after the operation; eighty-seven had a return, the whole number one hundred and nine, or more than half. Twenty-seven were operated on in the first year of the appearance of the disease.

"If, however, I were called on to draw a practical inference, a rule of conduct, from the documents I have collected, I should hesitate to make it, for I believe there are individualities in diseases as well as in other things; but if it were absolutely requisite, I should say that, excepting cancers of the skin, including those of the lips, it would be advantageous not to operate. I do not, however, wish to put myself in this situation, and at present would confine myself to the following conclusions, *first*, that the extirpation of cancroid tumours does not arrest the progress of the disease; *second*, that there is no advantage in performing the operation from the first, if it were not for the cancerous buttons, or cancers of the skin: *third*, that it was not necessary to extirpate cancerous organs, but in cases where hæmorrhagies, caused by the ulceration, put the patient's life in danger."—(p. 456–58.)]

2409. The *treatment* for effecting dispersion is precisely the same as that already given, (*par.* 68,) for getting rid of hardening. This mode, when not employed with the greatest care, is easily dangerous; for true *scirrhus* is not dispersed by it, and the continued employment of violent remedies destroys the constitution, and favours the passage of the disease into open cancer. When this treatment, that is, leeches, bloodletting, spare diet, purging, and remedies acting on the lymphatic system, softening and soothing applications have effected the dispersion of scirrhous swellings, there can be no doubt of the correctness of the *diagnosis*. This mode of treatment, therefore, can only apply in those cases where removal is impossible, and the cancer has been very tedious in its progress, as in such cases experience has proved that with this palliative treatment the disease may exist for many years without particular inconvenience, whilst by an active treatment it may be urged on to a frightful extent.

Compression of *scirrhus*, increased gradually to a very great degree, as recommended by Samuel Young (*a*), has been, on repeated experiment, not found to correspond with our expectations, but even causes a quicker and more serious progress of the disease (*b*). Recamier's more recent experiments, however, speak more favourably for this practice. It appears from his numerous observations, that in incipient scirrhous swellings, compression can restore the tissue of the diseased part to its natural condition without depriving it of its nourishment; in further advanced swelling, the tissue diminishes, and passes into a cartilaginous condition. When the organ has lost its proper structure, and is converted into a cartilaginous or lard-like substance, it may be lessened by compression, without restoring its organization, and may become atrophic. The adhesions of the swelling with the surrounding tissue is not only not increased, but lessened, and even the thin adherent skin may be restored to its natural state. By this diminution of the adhesions, an actual enucleation of the tumour, after previous division of the skin with escharotics or the knife, may be effected with the fingers. Recamier also believes that the return of a *scirrhus* which has been removed after the previous employment of compression is less to be feared, than when it has been removed without it. Compression may be employed in the most careful and gentle manner, and most effectually by linen or flannel bandages with soft German tinder beneath it, and accompanied at the same time, according to the circumstances of the case, with the internal and external use of suitable remedies, hemlock, mercury, iodine, depletives, repeated application of leeches, and the like (*c*).

[If pressure be at all employed in the attempt to cure scirrhous tumours, the best mode of its application is probably by means of the circular air cushion, invented by Dr. N. Arnott, which can be filled more or less completely, according to the pressure the patient can bear, and over it a sort of wooden bowl corresponding to the size of the part to be compressed, which is fastened on with a bandage. The only result, however, which I have noticed from pressure is, that whilst it diminishes the depth of the tumour, it spreads it in width, and does no real service.—J. F. S.]

2410. The removal of the diseased part with the knife, or its destruction with escharotics, are the only remedies which can be employed with the least certainty; a return of the disease is, however, under the most favourable circumstances, to be dreaded. Both before and after the operation it must be endeavoured by treatment to improve the constitution by the proper use of iodine and the like, by purging, and suitable regulation of the mode of living, to ensure, as far as possible, a favourable result. Both modes of proceeding (the knife and escharotics) are, on the other hand, contra-indicated when the cancer has already made so great progress, that it must be considered a constitutional affection, and when so situated, that all the degenerated part cannot be removed. The operation must also be put off, if the health of the patient be disturbed by other causes, and the diseased part be particularly painful.

The removal of a cancerous swelling, when it has already made such progress that no cure can be expected to result from it, may, however, in many cases, have the advantage of alleviating, in many respects, the sufferings of the patient, by the removal of the large ulcerating tumour.

2411. The mode of proceeding in the removal of cancerous parts varies, according to their seat and other circumstances, and is to be managed generally according to the directions already given for removing encysted tumours (*par.* 2258.) The following points must, however, as far as possible, be borne in mind. Every thing must be removed which is in the least diseased. These changes mostly appear in the cellular tissue, surrounding the hardened parts; so much of it must, therefore, be taken away that the tumour, after its removal, should be still surrounded with a

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(*a*) Minutes of Cases of Cancer and cancerous tendency successfully treated. London, 1816-18; 2 vols. 8vo.

(*b*) Charles Bell, Surgical Observations; being a Quarterly Report of Cases in Surgery, treated in the Middlesex Hospital, in the Cancer Establishment of that Institution, vol. i. p. 4.

(*c*) Révue Médicale. 1827; vol. i. p. 96.—Sur le Traitement du Cancer. Paris, 1829; 2 vols. 8vo.—Bluff, Ueber die Compression beim Brustkrebse; in von Siebold's Journal, vol. xix. part ii. 1835.

layer of cellular tissue. The bottom of the wound must be most carefully examined, and every thing infected removed. The healthy skin must be, as far as possible, preserved, to produce quick union of the wound, and to prevent suppuration and an unseemly scar. It seems also advisable, always to put in issues previous to the operation, and to keep them up properly.

The practice of many Surgeons, to apply an escharotic paste immediately after the operation, or towards the end of the healing, (KERN,) for the purpose of preventing the return of the disease is unnecessary, if it have been *completely* removed. MARTINET's proposal of covering the wound with a transplantation of skin, for the purpose of preventing recurrence, has also not been confirmed by experience.

2412. The *destruction of a cancerous part by caustic* can only be undertaken in cases where the cancer is superficial, and the whole of its glands uninfected, therefore, especially in cancer of the skin. The remedy most used is arsenic, in form of COSME's powder (1); more rarely are employed bichloride of mercury, nitrate of silver, the concentrated acids, and the like. COSME's powder must be made into paste with water or spittle, and spread with a spatula upon the ulcer, which has been dried with lint, and to such extent, that its hard edges be completely covered: if bleeding occur during its application, its further use must be withheld. The whole surface is then to be overlaid with spiders' web, or left uncovered. The pain caused by this powder is generally very severe for some hours; considerable swelling takes place in the neighbourhood of the ulcer, and an erysipelatous inflammation spreads over the surrounding parts. Bags of aromatic herbs, or fomentations of warm milk, are the best for soothing these effects. The more severe these symptoms are, the more effectual may the operation of the caustic be expected to be. In eight, ten, or fourteen days the slough separates; the loose pieces only may be cut off with scissors, without disturbing in the least that which remains still attached. When a clean ulcer remains after the separation of the slough, it heals with simple dressing; but if it be not clean the caustic must be repeated.

(1) This powder consists of one ounce of cinnabar, half an ounce of dragon's blood, one dram of white arsenic, and one dram of charcoal, very finely powdered and mixed.

Among the various remedies proposed for destroying cancerous parts, chloride of zinc, in powder alone, or mixed with flour into a paste, or in solution, has been recommended (HANKE, CANGUOIN, and others.) CANGUOIN employs chloride of zinc in four proportions; *first,* equal parts of the chloride and flour; *second,* one part of the chloride and two of flour; *third,* one part of chloride and three of flour; *fourth,* one part of the chloride of zinc, one of butyr of antimony, and one and a half of flour. In widely-spread cancer of the skin, these applications are advantageous, as symptoms of absorption of the arsenic are not to be feared (*a*).

2413. A peculiar mode of applying COSME's powder has been proposed by HELLMUND (*b*). The diseased parts are to be carefully cleansed, either by washing with water, or if there be a crust, by loosening and removing it with a spatula. The diseased part is then, according to its form, to be dressed with pledgets of very fine soft lint, spread with arsenical ointment (1), as thick as a card. The pledgets are to be applied singly to

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(*a*) BARRAUD RIOFREY, New Treatment of Malignant Diseases and Cancer without Excision. London, 1836.

(*b*) BRETSCHLER, Acte zusammengest; in RUST's Magazin, vol. xix. p. 55.

the different depths of the ulcer, and very closely pressed with the probe, so that they may be well applied, and extend beyond the edges of the sore about two lines, or if there be only spots, upon the surrounding healthy skin. If the edges of the ulcer be much swollen, it is necessary to apply the arsenical ointment, first upon them, and then to put on the pledget. In this way the dressing is to be applied once a day, and each time the sloughs must be removed. Shortly after the application of the ointment a burning is felt, which soon amounts to pain, that often becomes severe. According to the degree of pain, and the inflammation in the immediate neighbourhood, it must be determined whether the salve should be made more active by the addition of COSME's powder (2), or made milder by mixing with it resin ointment. On the third or fourth day, the pain, swelling, and redness gradually diminish; but the ulcer, which has increased in size, assumes a foul appearance. Its fungous and lard-like bottom, which secretes a sort of pus, begins on the fourth or fifth day to become putrescent, or to secret a thin ichor. On the fifth or sixth day, this is changed into a soft, moist slough, which cannot be removed like the slough of an abscess, but must be again covered with the arsenical ointment. According as this treatment proceeds, too rapidly or too slowly, the arsenical ointment must be rendered weaker or stronger. When, on the sixth or seventh day, this white, felt-like slough has been completely formed, the sore must be dressed in the same way as before, daily, with balsamic ointment (3), spread as thin as the back of a knife upon lint or linen. On the ninth or tenth day, the line of separation forms and spreads around the whole slough, which on the fourteenth or fifteenth day is thrown off, and the wound exhibits a healthy suppurating surface. If this surface retain its healthy condition, it must be dressed, till cured, with the balsamic ointment; but if any one part still have a foul appearance, the arsenical ointment must be applied to it for two or three days, and when it is in this way brought into a putrescent state, without a slough being formed, it must be again dressed with the balsamic salve.

(1) This ointment is composed of one dram of COSME's powder and an ounce of the narcotico-balsamic ointment, well mixed together.

(2) HELLMUND's receipt for this powder is, two scruples of white arsenic, twelve grains of charcoal, sixteen grains of dragon's blood, and two drams of cinnabar, well powdered and mixed.

(3) The narcotico-balsamic ointment is made with black Peruvian balsam and extract of henbane, half an ounce each, four scruples of acetate of lead, forty minims of tincture of opium, and four ounces of wax ointment, well rubbed together.

2414. The length of time occupied by this treatment varies; most commonly, however, it does not exceed thirty or forty days, during which, no particular diet is necessary. In scrofulous and herpetic dyscrasy, the remedies already indicated are employed. In erythetic persons, the inflammation and fever are often so great, that special treatment is requisite. I have several times noticed, during the use of arsenical ointment, violent pains in the belly, and *diarrhœa*, which I could not, at least, ascribe to other causes. I can confirm, from numerous cases in my own practice, the advantageous effect of this mode of treatment. The gradual and progressive effect which may be increased or diminished at pleasure, and the fact, that it can be applied to deep parts and places where COSME's powder cannot well be used, are the advantages of this method. In cancer of the skin, in eating and sloughing spots, it is specially efficient; in some cases of cancer of the breast, it may be very curative; in fungous cancer, it has not any effect at all (*a*).

2415. If cancerous degeneration appear after repeated removal, or repeated application of caustic, or if the cancer be so situated that these modes of treatment are not applicable, we are restricted to the internal and external use of such remedies as specially act, partly against the local, and partly against the general symptoms, which arise from the absorption of the cancerous poison. To the former belong the internal use of arsenic, *belladonna*, *cicuta*, and *digitalis*, of cherry bay water, mercury, *calendula*, carbonate of iron, hydro-chloride of gold, *fucus helminthocorton*, iodide of potash, and the like. For external application, weak solution of arsenic, poultices of *cicuta*, *belladonna*, *digitalis*, *calendula*, of carrots with bichloride of mercury, and of yeast poultices, powdered charcoal, lime water, solutions of narcotic extracts, leeches, liquor of ammonia diluted with water, expressed juice of *onopordon acanthium*, sulphuret of potash, carbonate or phosphate of iron, made into a paste with water, and continued gradually increasing pressure. With this treatment, the mode of living must also be attended to, animal food must be avoided, and milk or vegetable diet ordered.

2416. In order to diminish the severe pain of an open cancer, the already mentioned narcotics, *opium*, *belladonna*, and *hyoscyamus*, partly serve. According to my experience, a solution of sulphuret of potash, in rose water, with the addition of extract of *hyoscyamus*, applied lukewarm, on napkins, is very beneficial for relieving the pain.

2417. When any part of an ulcer passes into a cancerous state in consequence of constant irritation, improper treatment, and the like, a soothing antiphlogistic treatment, as repeated leeching, warm fomentations, and poultices, quietude, and the like, must be employed, together with attention to the existing constitutional affection (*b*).

A.—OF CANCER OF THE LIPS AND CHEEKS.

2418. Cancer occurs only on the lower lip, at least I have never seen it as a primary affection on the upper lip. It appears either as a scabby or ulcerated spot, which gradually spreads, throws out fungous growths, and the like, or forms a hard shapeless swelling of the lip, which enlarges, becomes very painful, and breaks. It spreads gradually upon the skin of the chin, the mucous membrane of the mouth, the gums, the glands below the jaw, and destroys the entire lip and the bone.

The above described twofold mode of the production of cancer of the lip has been proved, by numerous microscopical observations I have instituted, to be *true cancer*, and *hypertrophy of the natural tissues* of the lip. In the latter, the *papillæ* of the *cutis* were hypertrophic, and very considerably lengthened. Whilst upon the whole surface of the *papillæ*, a plaster of epithelial cells had been formed, which continually grew, and were thrown off as scales; so was each *papilla* surrounded at its extremity with a thick sheath of *epidermis*, and thus a cylinder was formed, into which the base of the *papilla*, often capable of being drawn like a thread out of its sheath, entered. These cylinders, at first close to each other, were pushed apart by the scaling, though still held together on the surface by a layer of epidermal scales. In many cases, the *epithelium* formation was very great, and presented an appearance nearly allied to warts and *condylomata*.

(*a*) Chelius; in Heidelb. klinisch. Annalen, vol. iii.

(*b*) Henry Earle, On the influence of Local Irritation in the production of diseases resembling Cancer; in Med.-Chir. Trans., vol. xii. p. 284.

Ulcers on the lips are often malignant, without being cancerous; as the continual movement of the lips, and the flow of spittle and the like, prevent their healing, and keep up constant irritation. Syphilitic sores on the lips often assume a malignant character; they mostly begin with a vesicle which bursts, and the ulceration spreads from the skin to the other tissues. Not unfrequently, also, ill-conditioned ulcers are kept up by bad teeth (*a*).

2419. The only efficient *mode of treating* cancer of the lip is, the removal of the diseased parts by cutting them out; and this is preferable to the use of caustic. The operation is only contraindicated when the cancerous degeneration has spread considerably on the inside of the mouth, the submaxillary glands and so on, which render the complete removal of the disease impossible. The mode of operating varies according to the extent of the cancer.

2420. If the cancer do not spread down beyond the red part of the lip, and only affect more or less of the edge of the lip, it is best whilst holding the diseased part with the left hand, or with GRAEFE's *entropium*-forceps, and pulling it well up, to cut it off through the healthy part, by a slight sweeping cut with a pair of scissors curved towards their surface. The spouting labial arteries are to tied or twisted, and the wound covered with a sponge dipped in cold water till the bleeding ceases entirely. German tinder is then to be applied, and when after three or four days, suppuration is set up, a linen rag dipped in lukewarm water should be put on till the scarring is complete. In from ten to twelve days a linear scar is formed by the union of the mucous membrane of the mouth with the external skin, in consequence of which the lip draws up, so that in great loss of substance the alveolar process and teeth are more or less completely covered again; but in less loss of substance there is scarcely any noticeable depression of the lip remaining, as my numerous cases have proved. The ordinary way of removing the cancerous part by two cuts meeting at an angle, causes in these cases a great loss of substance (*b*).

[Notwithstanding CHELIUS's recommendation, I think the old method of treating these cases with the angular cut is safest; the depth to which the cut should be made of course will depend on the extent of the disease.—J. F. S.]

2421. If the cancer have spread down beyond the red edge of the lip, the whole degenerated part must be removed by two cuts which should meet at an acute angle. In doing this an assistant steadies the lip with his fingers on both sides, compressing the coronary arteries at the same time. The operator with the thumb and forefinger of the left hand grasps the diseased part, lifts it up a little, places the knife upon the edge of the lip, carries it obliquely downwards and inwards, and then makes another cut in the same way on the other side, so that a V shaped piece is cut out. Its connexion with the gums and chin is then divided, the spouting vessels twisted or tied, and the edges of the wound brought together as in the operation for hare-lip with the twisted suture (*par.* 727); in doing which the bleeding is generally stopped without any ligature.

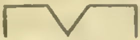
If the cancer spread from the corner of the mouth over the upper lip, the corner must be removed with a semilunar or an angular cut, and afterwards the V shaped cut must be made downwards. The wound at the corner of the mouth is first to be brought together horizontally or obliquely, and then the remaining wound readily meets.

(*a*) EARLE, above cited, p. 271.—CHELIUS; in Heidelb. klin. Ann., vol. iii.

(*b*) RICHERAND, Histoire des Progrès récens de la Chirurgie, p. 218.

The extensibility of the lip, especially when separated to a great extent from the gums and jaw, permits its union even in cases of enormous loss of substance, and gradually gets rid of the considerable deformity often at first present.

2422. When, therefore, even in very widely-extended cancer of the lip there is great loss of substance, usually by close attention to the above points, the bringing together of the lip is possible, and the at first much opposed drawing together and deformity of the mouth gradually ceases (*a*). Cutting into the corner of the mouth for the purpose of increasing its aperture, as by some recommended, is not only useless, but even prevents the due extensibility of the parts concerned by producing a hard scar. But when the loss of substance on cutting out a cancer of the lip is so great that the edges cannot be brought together, nothing remains but to make a new lower lip *(Chiloplasty)*.

2423. The different methods and proposals for forming an underlip may be arranged in the following way; *first*, the Italian mode of Chiloplasty, by transplanting the skin of the arm (TAGLIACOZZI, VON GRAEFE;) *second*, the Indian mode of Chiloplasty (DELPECH (*b*), TEXTOR (*c*), DUPUYTREN) (*d*), in which a piece, corresponding in size to that lost, is taken from the skin of the neck, turned round and united with the edges of the wound; *third*, separation of the neighbouring skin, and adroitly bringing together the cut and uniting it in different ways; α. CHOPART's method in which a vertical cut is made on each side of the cancer, extending down below the edge of the chin; the cancer is then removed with a transversely-curved cut, the flaps raised to the height of the edge of the lip and there fastened, the head being at the same time kept bowed forwards. The method of ROUX DE ST. MAXIMIN (*e*) corresponds with this, as do also those of BLANDIN and SERRE (*f*), the latter of whom endeavours to preserve the mucous membrane of the mouth, and with it to cover the upper edge of the wound. β. DIEFFENBACH's (*g*) method is the following; after the cancer has been removed, the soft parts are separated to sufficient extent from the gums and lower jaw on either side; then, for the purpose of relaxing the edges of the wound, two side cuts are made into the mouth itself; or by drawing together the soft parts from either side, a horizontal cut outwards being made at each corner of the mouth, and then a vertical cut carried down to the edge of the jaw . The two flaps are now drawn together in the middle and united with the twisted suture; their outer angles connected with the corners of the mouth, and the upper edge sewn with several interrupted sutures to the mucous membrane. γ. By BLASIUS's (*h*) method, after the cancerous parts have been removed by a semilunar cut from each corner of the mouth, uniting in an angle below the chin, a cut is made beginning from the right edge of the wound, about half an inch above the edge of the jaw, and carried a good thumb's breadth down-

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(*a*) CHELIUS, Gelungene Lippen und Nasenbildung an dem selben subjecte; in Heidelb. klin. Annal., vol. vi. part iv.

(*b*) Chirurgie Clinique de Montpellier, vol. ii. p. 587.

(*c*) OKEN's Isis, vol. xxi.; p. 496. 1828.

(*d*) Difformité corrigée par la transport d'une partie du corps sur une autre; in Révue Médicale, 1830, vol. iii. p. 283.

(*e*) VELPEAU, Nouveaux Elèmens de Médecine Opératoire, vol. ii. p. 33.

(*f*) SERRE; in Gazette Médicale de Paris, vol. iii. p. 238. 1835. No. 15.

(*g*) ROST, Dissert. de Chiloplastice et Stomatopoesi. Lips., 1837.—ZEIS, Handbuch der plastischen Chirurgie, p 419.—BAUMGARTEN, Dissert. de Chiloplastice et Stomatopoesi. Lips., 1837.

(*h*) Klinische Zeitschrift für Chirurgie und Augenheilkunde, vol. i. p. 387. Halle, 1836.—VON AMMON und BAUMGARTEN, Die plastische Chirurgie nach ihren bisherigen Leistungen, p. 129. Berlin, 1842.

wards, again brought up in a curve to the edge of the jaw, and continued along it to the edge of the *m. masseter*. This flap is now to be separated from the jaw, and afterwards a like one having been made on the left side, both are to be drawn inwards and upwards, so that they replace the lower lip, and are then brought together with the twisted suture. Both angles formed by the soft parts on the sides of the chin are now to be dissected up, and so drawn upwards and towards each other that they touch the line of union of the new underlip, and the lower edge of the latter is brought into immediate connexion with the raised skin, in which position the edges of the wound are to be kept together partly by the twisted and partly by the interrupted suture, the head being at the same time bent downwards.

2424. In considering these different methods and performances of Chiloplasty, with the exception of the very difficult and in its consequence uncertain Italian transplantation, it must be remembered that in the insertion of a flap turned round from the skin of the neck, as well as in the mere drawing up of the separated flaps, the bare part of the jaw indeed may be covered, but generally the upper edge of the skin which is firmly connected to the bone, puckers together, rolls inwards, irritates by the growth of the beard, and can only assume in some degree a natural appearance, if it be possible to stitch it to the mucous membrane of the mouth. These circumstances apply in like manner, though in less degree, to Blasius's method; and are most favourable in Dieffenbach's operation; but it is very bad when the side flaps on drawing together do not meet each other, either at the corner of the mouth, or are destroyed by gangrene. In the closure of the side openings, under both operations, nature is very active, and may be assisted by touching with lunar caustic or by making little side cuts (*a*).

2425. If the cancer of the lip have extended to the bone or have arisen from the bone itself, under which circumstances the use of caustic, of the actual cautery and the like, in general merely increase the mischief, the only remaining remedy is the removal of the chin first practised by Deaderick and Dupuytren. In order that this operation should be successful, the skin must be healthy to such distance that it is possible to cover the part where the bone has been sawn off; and the swelling of the neighbouring glands and the signs of general cancerous dyscrasy do not particularly forbid such operation. The mode of proceeding will be hereafter considered when the removal of the lower jaw is treated of. It is further to be remarked that in cases where the bone is not diseased, its removal, however, may be requisite, for the purpose of obtaining room to bring the soft parts together (Roux).

2426. In cancer of the cheeks and other parts of the face, its destruction is commonly undertaken with Cosme's powder; where however the seat and nature of the disease permits it being cut off, that method is most proper.

B.—OF CANCER OF THE TONGUE.

2427. *Cancer of the tongue* commonly begins with a hard circumscribed swelling at one side or other of that organ; there is lancinating pain; the swelling breaks and quickly spreads with the peculiar characters

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(*a*) Zeis, above cited, p. 426.

of cancerous ulceration. Various swellings and ulcers which occur on the tongue, very often assume a malignant appearance; the loose tissue of the tongue, its continual moisture from the spittle, and pointed, decayed teeth very commonly keep up stubborn sores. Not unfrequently the *papillæ* on the *dorsum linguæ* enlarge and form fungous excrescences. Syphilitic ulcers of the tongue commonly degenerate into cancer.

2428. The *prognosis* depends on the seat of the disease, its extent and cause. If an ulcer of the tongue have assumed, in consequence of continual irritation or improper treatment, an ill-conditioned character, it may often be cured by proper local and general treatment; to which treatment the Surgeon is restricted in those cases of ulcerated cancer which are beyond the reach of any operation.

Every irritant, every mischievously projecting, irregular, or sharp tooth, must be removed, the tongue protected by covering the other teeth with wax, talking entirely forbidden, the mouth often cleansed with lukewarm water, or a solution of extract of hemlock with honey, only bland food taken, and in bad cases all solid food avoided. If the glands beneath the chin be swollen, or the ulcer very irritable, leeches must be applied repeatedly. The patient should frequently during the day hold carrot-pulp in his mouth, which operates partly as a fomentation, and partly as it has the effect of completely preventing the patient from talking and moving his tongue. Instead of the application of a solution of lunar caustic, or of dilute hydrochloric acid, three to four drops in an ounce of water, and sometimes a solution of arsenic, as recommended by HENRY EARLE (*a*), I employ mild soothing remedies with the best effect. Extract of hemlock in increasing doses may be given internally. For syphilitic ulcers, mercurial treatment, and ZITTMANN's decoction may be employed, and in other cases, the several preparations of gold. If by these remedies the progress of the ulcer cannot be checked, it is decidedly cancerous; or if there be a scirrhous swelling, the removing of the degenerated part is necessary, provided that no general dyscrasic disease keep up the affection of the tongue, that it be not degenerated at the root, and that the neighbouring glands and tonsils be not affected. It must, however, be remarked, in reference to the last point, that the application of many leeches at first and of a few afterwards, often disperses this swelling (*b*).

HEYFELDER (*c*) thinks that in scirrhous hardening of the tip of the tongue, the operation may be deferred as long as there is no trace of transition into cancer.

2429. The removal of the cancerous part of the tongue is managed in the same way as the operation for shortening a very large tongue (*par.* 2162); it differs, however, according to the seat and extent of the cancerous degeneration. The patient seated on a stool, and having his head fixed by an assistant standing behind him, protrudes the tongue as far as possible, which is then to be held with the assistant's fingers covered with linen, or with a pair of polyp-forceps, with which the back of the tongue is grasped, firmly pressed together and fixed; the diseased part is to be held with the fingers or with a pair of hook-forceps, a hook or a thread passed through it. The degenerated part being now drawn forwards, is to be cut off with a bistoury, or what is better with the kneed or COOPER's scissors; the direction

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(*a*) Above cited, p. 285.

(*b*) LISFRANC; in Révue Médicale, 1827. vol. ii. p. 69.—JAEGER, De exstirpatione Linguæ. Erlangen, 1832.

(*c*) Ueber Zungenkrebs; in Studien im Gebiet eder Heilwissenschaft, vol. i. p. 183.

and shape of the cut being decided by the seat and shape of the disease. When the ulcer or the *scirrhus* is not large, specially if it be on the tip of the tongue, it may be removed by two cuts connected at an angle, so that the wound may be brought together with suture; although HEYFELDER holds it better not to effect the union this way, but to leave it to nature. If the cancer be on one side of the tongue, that organ must be divided by a cut lengthways, and a second cut made transversely or obliquely behind the degenerated part. If the disease extend far back, it is necessary first to divide the cut on the corresponding side to obtain more room. If the tongue be degenerated throughout its whole thickness and far back, the cheek must also be first divided, and when the tongue has been properly protruded and fixed, it must be cut off with two strokes with COOPER's scissors from the side towards the middle. The bleeding which always accompanies this operation must be stopped as far as possible by ligature, by styptics, by pieces of ice held in the mouth, by solution of alum, or by the actual cautery. The edges of the wound are then to be carefully examined, and every hard knot or diseased part seized with the hook or forceps, and removed with the scissors.

The *after-treatment* must, according to the degree of the ensuing inflammation, be more or less antiphlogistic; the patient must not talk, and only eat mild nourishing broth. When suppuration takes place, bland mouth-washes must be used. If the suppurating part assume a bad appearance, it must be touched with caustic, or with the actual cautery, and at the same time a corresponding general treatment employed.

After the cure, the speech is more or less affected, according as more or less of the tongue has been removed; it, however, gradually improves if the lost part have not been very great.

Fungous growths of the tongue must be cut off at their base, either immediately or after the application of a ligature around the tongue, and the bleeding surface touched with the actual cautery *(a)*.

Tying the lingual arteries (*par.* 1444) which has been proposed for the special object of preventing bleeding in cutting off the tongue, is partly on account of its great danger and difficulty in stout persons, improper, but specially so, because experience has shown that even in deep removal of the tongue the bleeding may be stanched by ligature and other remedies. JAEGER, for these reasons, thinks it required only in cases of considerable varicose or aneurysmatic affections of the tongue, or in its total removal, when the remainder of the tongue cannot be laid hold of.

2430. The *removal of the tongue by tying*, which is done either with a single ligature, or with a double thread, passed through with a needle, and tied on both sides, is indeed a security against bleeding, but the painfulness of this method, the inconvenience caused by the swelling of the tongue, by its sloughing and the like, generally leads to the preference of removal by cutting; cases, however, may occur, where a mixed treatment may be requisite. If, for instance, the tongue be diseased far back on one side, the diseased may be separated from the healthy part by a cut extending sufficiently far back, the diseased mass drawn forwards with the forceps, and a ligature applied with the loop-drawer, at the root of the degeneration (*b*). Otherwise, experience shows, that in such cases, the removal by cutting has favourable results (*c*).

(*a*) VON WALTHER; in his Journal für Chirurgie und Augenheilkunde, vol. v. p. 210.—JAEGER, above cited.—DELPECH, Sur un Cas de Cancer de la Langue, qui a entraîné la perte totale de cet organe, et qui a fourni l'occasion d'étudier la part qu'il prend à la formation de la parole; in Révue Médicale, 1832. vol. ii. p. 384.

(*b*) LISFRANC, above cited.

(*c*) JAEGER, above cited.—REICHE, Ueber partielle und totale Exstirpation der Zunge; in RUST's Magazin, vol. xlvi. part ii.

As Cloquet had previously opened the bottom of the mouth for the introduction of a ligature, so Mirault (*a*) proceeded in a case, in which he had fruitlessly endeavoured to find the lingual artery on one side, although he had taken it up, with difficulty, on the other, after which, the tumour diminished, but increased again. He made a cut from the chin to the tongue-bone, directly in the space between the *m. geniohyoidei*, through which he pierced the tongue at the middle of its base, and surrounded the left half with a ligature, the ends of which hung down from the neck, and were there tied. Afterwards he tied the other half. If thus tied at two different times, the cancer may be cured without mortification of the tongue, which retains its shape and activity. According to Mirault, the cut into the bottom of the mouth is assisted, if the tongue be drawn well forward with a hook, and a needle curved sideways with a handle, like Desault's aneurysmal needle, be thrust through the middle line of the tongue from above, downwards, so that its point protrude below, at the part where the tie is to be made; the one end of the thread is now to be held fast, the needle with the other end drawn back, and then the threads tied.

With Mirault's, agrees the practice of Regnoli (*b*) for removal of the tongue. He made three cuts in the form of T from the lower edge of the point of the chin to the tongue-bone, and on either side to the front edge of the *m. masseter*. The skin, cellular tissue, and *m. platysma myoides*, were dissected off, a pointed straight bistoury thrust behind the chin from above downwards, the insertion of the *m. geniohyoidei* and *genioglossi* were cut through, and the mucous membrane of the mouth divided. With a button-ended bistoury, the insertions of the *m. digastrici* and *mylohyoidei*, and the mucous membrane of the mouth were now cut through up to the pillars of the soft palate. After tying a few vessels, the tip of the tongue was seized with Museux's forceps, and drawn down to the lower opening, so that the whole tongue was seen on the front of the neck, and pulled well down with the fingers. Several ligatures were now applied with a long curved needle around the root of the tongue; the tongue cut off with a small pair of shears in front of the ligature; its stump returned into the cavity of the mouth, and the wound closed. Ice was put into the mouth to keep down the inflammation.

[Arnott (*c*) has also performed this operation for a malignant tumour of the tongue of a girl of fifteen, which was as large as a pullet's egg, projected from the upper and under surface at its right side from nearly half an inch of its apex to the *isthmus faucium*, and protruded at the edge between the teeth. "The head being slightly extended, and the *os hyoides* felt, an incision was made over it, upwards and forwards, an inch and a half in length, on the mesial line, through the skin, cellular substance, and *raphe* of the mylothyoid muscles. With the edge of the knife, but chiefly by its handle, way was made for the finger between the two genio-hyoid and the two genio-glossal muscles. A tenaculum was next passed through the apex of the tongue, by means of which it was drawn out of the mouth, and held so during the subsequent part of the operation. Into the wound in the neck a strong needle, with an eye at the point, in a fixed handle, was now conducted and passed through the basis of the tongue into the *pharynx* a little to the left of the mesial line: the loop of ligature which it carried was then, by means of a blunt hook drawn forwards out of the mouth, and the needle withdrawn from the wound over one of the ends. The loop being cut, two ligatures were obtained; one of these was placed along the upper surface of the tongue, so as to bound the disease on its left side, and carried through the apex of the tongue, from above downwards, by means of a large curved needle, through which the oral end of the other ligature was *now* also passed. Fixed in a *porte-aiguille*, this needle was next carried through the floor of the mouth, immediately behind the last molar tooth, on the right side, directed at first, and for the greater part of its course, perpendicularly downwards, then inclined mesial, and brought out at the incision in the neck. There were thus two ligatures, the four ends of which being out of this wound: one of the loops was so disposed as to encircle the right half of the tumour; the other was placed longitudinally on the upper surface of the tongue, longitudinally and obliquely below. Being tied, (and this was done as tightly as possible,) the diseased mass was circumscribed posteriorly, laterally, and, in some measure, inferiorly. A third ligature was now passed through the fore part of the tongue, so as to isolate, at this part, the diseased from the healthy structure." (p. 23–25.) This proceeding fixed the tongue in the mouth, and she became unable to articulate or swallow. She was fed for a fortnight on milk by an elastic catheter passed along the left side of the tongue into the *œsophagus*. The swelling of the sound part of the tongue, and the salivation which

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(*a*) Gazette Médicale de Paris, vol. ii. p. 507. 1834. August. No. 32.

(*b*) Bulletino delle Scienze Mediche. Jan., 1839. No. 181.

(*c*) Med.-Chir. Trans., vol. xxii. 1839.

ensued, were moderated by active purging. On the second day, "the circumscribed portion of the tongue was black and pulpy, and portions of it began to separate. This continued until the fifth day, when, on removing some of these, I discovered that the sloughing was confined to the surface, and that the more soft part of the tumour underneath was still alive, as it bled on being scratched. I endeavoured to complete the strangulation by carrying a canula over the ligatures, hanging out of the wound of the neck up towards the root of the tongue, and tightening these afterwards by twisting and maintaining them so, but without a successful result." * * * "On the eleventh day the *diseased* was completely separated from the *sound* half of the tongue by a deep trench, so as to give it a truly bifid character, and the trench was continued across the basis, seeming to extend through the whole thickness of the part. * * * Reunion by granulation had commenced between the diseased and sound portions of the tongue, but this was easily broken down by the probe. It was now evident that the former part derived some vascular supply from below, and the following method was employed to cut this off. A loop of silver wire, properly bent, was passed over it from the mouth, carried and depressed into the trench already mentioned as surrounding it, and being drawn forwards, the diseased part was found to be placed completely above the level of the loop. The two ends of the wire were next passed through a double polypus-canula, and this being carried home under the tumour, to what may now be considered its neck, the ligatures were tightened, the death of the part effected, separation ensuing on the fifth day, (the seventeenth from the first operation.") (p. 23-28). The case succeeded completely, and at present, Oct. 1846, she is quite well.]

C.—OF CANCER OF THE PAROTID GLAND.

Kaltschmied, De Tumore Glandulæ Parotidis feliciter exstirpato. Jenæ, 1752.

Siebold, C., Parotidis scirrhosæ feliciter exstirpatæ Historia. Erford., 1781.

————, (Resp. Orth.,) Dissert. de Scirrho Parotidis. Wirceburg, 1793.

Siebold, B., Historia Systematis Salivalis, p. 151. Jenæ, 1797.

Ohle, Erfahrungen ueber die Ausrottung der Ohrspeicheldrüse; in Zeitschrift für Natur- und Heilkunde, vol. i. part i. Dresden, 1819.

Klein, Ueber die Ausrottung mehrere Geschwülste, besondes der Schild- und Orspeicheldrüse; in von Graefe und von Walther's Journal für Chirurgie und Augenheilkunde, vol. i. p. 106. 1820.

Kyp, (Præsid. Walther,) Dissert. de Induratione et Exstirpatione Glandulæ Parotidis Bonnæ, 1822.

Braamberg, Dissert. de Exstirpatione Glandulæ Parotidis et Submaxillaris. Gröning. 1829. 4to.

2431. The parotid gland is subject to a variety of degenerations of its tissue, by which its size is increased, and a larger or smaller swelling is produced. It may be the seat of induration, of a sarcomatous degeneration, of *scirrhus* and cancer, and of medullary *fungus*. Encysted tumours in the tissue of the parotid, or in its neighbourhood, as well as swellings of the neighbouring glands, may be easily mistaken for a swelling of the parotid itself.

2432. The swelling of the parotid is characterized by there being always a circumscribed tumour between the mastoid process and the ascending branch of the lower jaw, which lifts the ear up, and enlarges in a more or less irregular, oftentimes egg-shaped or pyramidal form. The axis of the swelling always corresponds to a straight line, continued from the mastoid process towards the angle of the lower jaw, or little deviating therefrom, if the swelling be not very large; and it forms a pyramid, the base of which lies upon the ascending plate of the jaw, but its apex projects freely

2433. The following circumstances serve for the closer distinction of the several tumours of the parotid gland. *Scirrhus* forms a swelling not very bulky, of stony hardness, irregular on its surface, having clefts and globular projections, almost immovable, protruding little externally, though it spreads rather deeply, compresses the vessels and nerves, and declares its cancerous nature by the lancinating pain. *Induration* of the parotid remains after previous inflammation, (*par.* 141,) feels less hard and uneven than *scirrhus*, and shows no sign of concealed cancer. In *sarcomatous degeneration*, the swelling is softer than in *scirrhus* or induration, its growth is rather quick, it is movable, and may also be raised from below. *Medullary fungus* of the parotid forms a swelling which quickly attains an enormous size, and from whence, on its bursting, fungous growths arise, and bleedings frequently occur.

2434. From the above-mentioned swellings of the parotid gland, *encysted tumours*, which are developed in the *parenchyma*, or on the covering of the gland are distinguished by having mostly a roundish form and regular surface; their front surface is often compressed; they are not developed equally; they feel soft, and fluctuate indistinctly. In *tumours of the absorbent glands*, there are always several swollen at the same time, the swellings are softer, and there is a general appearance of scrofulous disease. *Tumours of the submaxillary glands* are distinguished from those of the parotid by the seat of their development.

2435. In *scirrhus*, as well as in medullary *fungus* of the parotid, removal is the only remedy, though a doubtful one. Various means have been advised for the dispersion of induration, as hemlock, antimony, mercury, barytes, and iodine; for external application, mercurial, or iodic ointments, poultices, dry bags of hemlock, *hyoscyamus*, *belladonna*, *stramonium*, softening steam of these herbs, dispersing plasters. In sarcomatous swellings of the parotid, perhaps some decrease may be effected by repeated applications of leeches, by issues on the tumour, or in its neighbourhood, and by a seton drawn through the tumour. These means lessen the increased nourishment of the swelling, by the inflammation excited by the seton producing obliteration of the vessels, and the swelling is destroyed by the suppuration. Such modes of treatment, however, can only be employed with the hope of a favourable issue in cases of not long standing degeneration of the parotid, and when it has little increased in size. It must, however, be remembered, that attempts at dispersion may cause a quicker growth of induration. When in sarcomatous degeneration, the vessels are very numerous, the introduction of a seton may produce great bleeding.

2436. The removal of the parotid gland belongs to the most difficult and dangerous operations, and is by many considered totally unpermissible, as the close connexion of the gland with the important neighbouring parts, renders necessary the wounding of very important vessels and nerves, hence the danger of bleeding, and of fatal nervous symptoms; besides, the swelling of the parotid, in ordinary cases, is productive of no danger, and is not cancerous (*a*). Experience has repeatedly proved the possibility of extirpating the parotid without the occurrence of these accidents.

The parotid gland is covered with a fibrous capsule; if this be not adherent to the tumour, and if during the operation it can be spared, the removal is far easier and less dangerous than when the capsule and tumour are united. The vessels which may be wounded during the operation are, the temporal, anterior aural, transverse facial, and external maxillary arteries or their branches, which are often considerably enlarged, and even

(*a*) Richter, Anfangsgründe, vol. iv. *par.* 401, 402.

the carotid artery itself, which is often completely enclosed in the parotid gland. If the Surgeon operate with due care, and with intimate knowledge of the parts, he may almost always avoid injuring the trunks of these arteries; even, however, if one or other be wounded, fatal bleeding may be prevented by one or other of the under-mentioned remedies. Numerous twigs from the third branch of the fifth pair, the communicating facial and from the third pair of cervical nerves must indeed be cut through in removing the parotid, but the trunk of the facial nerve is not necessarily divided (*a*).

The removal of a scirrhous tumour of the parotid gland is always most difficult and dangerous, because it is firmly connected with the surrounding parts, and if any of the disease be left, no cure can be expected. In induration and *sarcoma* the tumour is more movable, the surrounding capsule may therefore be left alone, and does not at all interfere.

Allan Burns (*b*) believes that in all cases where the parotid has been held to have been removed, it was not the gland itself, but a diseased conglobate gland, of which there are commonly two accompanying the parotid, the one under the lobe of the parotid, and the other on its middle, and lying opposite the division of the external carotid, into maxillary and temporal arteries. The former is not so deep, and is simply covered with the cervical *fascia* and the lobe of the parotid. Burns attempted the removal of the parotid on the dead body, but even there failed to remove all the diseased substance (*c*).

2437. For *the extirpation of the parotid gland*, it is most convenient to lay the patient upon a narrow table covered with a mattress, in such way on the healthy side, with the head a little raised, that the light may readily fall upon the swelling. If the tumour be not very large, the skin covering it not connected with it, and not diseased, an assistant fixes the swelling on each side with his fingers, thrusting it upwards at the same time, and rendering the skin tense; a longitudinal cut must then be made through the skin from the mastoid process to the angle of the jaw. If the swelling be larger, a crucial cut must be made; and if the skin be attached and diseased, two semilunar cuts must be made and connected above and below, including the diseased skin. The *m. platysma myoides* is to be next cut through, and all the spouting vessels tied. The skin must now be separated from the surface of the whole swelling; the fibrous capsule opened sufficiently, and the tumour shelled out with the fingers or with the handle of the scalpel. The blade of the knife must be only used with the greatest caution, for the purpose of separating the firmer connexions. During the operation, an assistant must constantly sprinkle cold water to keep the wound clear of blood, on which account, also, every spouting vessel should be immediately tied. In *sarcoma*, the substance of the swelling is often not of a sufficient firmness to permit it being at once shelled out with the finger; it often tears, and the several parts must be removed piecemeal. When the fibrous capsule adheres to the gland, and cannot be freed, the separation of the tumour is exceedingly difficult, and requires the greatest caution.

2438. When on separating the swelling at its hinder part, a very firm connexion of it to the carotid artery running behind, or through its substance, is perceived, a ligature may be applied round the tumour, after isolating as much as possible; or the trunk of the carotid artery may be tied, and the removal completed (*d*). When the tumour dips deeply, and

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(*a*) Kyll, above cited.

(*b*) Surgical Anatomy of the Head and Neck, p. 267.

(*c*) See also Bérard, Maladies de la Glande parotide et de la région parotidienne, Opérations, que ces Maladies réclament. Paris, 1841.

(*d*) Zang, Operationen, vol. ii. p. 618.

its close connexion with the carotid artery is suspected, that vessel may be tied some weeks before the extirpation, which will then be performed with greater safety. In many tumours of the parotid, the ligature of the artery will indeed cause, by the diminution of the flow of blood, such decrease of the size of the swelling as to render its removal superfluous (*a*).

The previously tying the carotid artery, which was performed by **GOODLAD** (*b*), does not ensure against bleeding, which quickly follows, from the numerous anastomoses and the quickly-restored collateral circulation. Thence **LANGENBECK'S** (*c*) advice, when, on account of the expansion of the vessels, or the firm connexion of the tumour, it is scarcely possible to avoid injuring the artery, first, to lay bare the artery, and include it in a ligature, which must be tightened if the vessel be injured, or the bleeding from its branches be great. I have, however, in one case, where the carotid was closely connected with the swelling, avoided wounding it in the total removal of the tumour, by which the vessel was so perfectly exposed in the wound that I could raise it with my fingers, and in case of having wounded it, could have easily applied a ligature.

2439. If, during the removal of the parotid gland, the carotid artery be wounded, it must be attempted to seize it with a hook, and tie it; but if this be not possible, the bleeding may, perhaps, be stanched by pressure with the fingers, or by plugging, which, at least, has been done on one case of wounded facial carotid with success (*d*); or the wounded part of the artery may be compressed, and the common trunk of the carotid artery tied at once.

2440. After the extirpation is completed, the wound must be properly brought together, the ends of the ligatures carried out in the shortest direction, the edges of the wound carefully closed with sticking plaster, and the patient put to bed with his head a little raised, and inclined to the diseased side. The accidents which may occur after the operation, as severe inflammation, nervous symptoms, after bleeding, and the like, require the ordinary treatment.

I have, up to the present time, performed eight extirpations of the parotid gland, without any untoward accident resulting from the operation.

Cases of extirpation of the parotid gland are related by

PRIEGER; in **VON GRAEFE** und **VON WALTHER'S** Journal, vol. ii. p. 454; and in **RUST'S** Magazin, vol. xix. p. 303.

BERENDTS; in the same, vol. xiii. p. 159.

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WEINHOLD; in Salzburger Medic.-Chirurg. Zeitung, vol. iv. p. 63. 1823.

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D.—OF CANCER OF THE BREAST.

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TABOR, (Præs. **SERRURIER**,) Dissert. de Cancro Mammarum cumque novo exstirpandi methodo. Traj. ad Rhen., 1721.

(*a*) **KYLL**, above cited, p. 18.

(*b*) Med.-Chir. Trans., vol. vii. p. 112. 1816.

(*c*) Bibliothek, vol. i. p. 400.

(*d*) **LARREY**, Mémoires de Chirurgie Militaire, vol. i. p. 309.

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Brodie, Sir B. C., Lectures on Pathology and Surgery, above cited.

2441. The breast-gland is most commonly affected with *scirrhus;* but in men this occurs very rarely. As to its origin and progress, all that has been said generally on cancer of glands applies; its development and course, however, present some differences.

2442. Most commonly a hard lump, round and movable, arises without any previous cause, or after a blow, a squeeze, or the like; as it grows it becomes irregular and knobby; a second and third lump is produced, which seem connected together by strings of hardened cellular tissue. As these several lumps enlarge, they become molten into each other and with the gland, and spread especially towards the arm-pit. Passing, lancinating pains set in, which are not increased by pressure, and spread towards the shoulder, and over the arm. As the swelling increases, and the pain becomes more severe, they attack the skin, which assumes a channeled, scar-like appearance, and the sebaceous glands are often filled with a black substance. The skin becomes attached to the tumour, which rises considerably at one point, reddens, and thins; the veins swell, the nipple retracts, and instead of a prominence, exhibits a hollow. The skin at last breaks, and an ulcer forms, spreading in every direction, with hard, dusky red, glossy edges, and having a foul, sloughy bottom, though not with any very copious and offensively-smelling discharge; the ulcer is rather a deep cleft, without any fungous excrescences. The glands in the arm-pit, on the collar-bone, and the neighbourhood, swell up, if they have not so previously. At this time, often even earlier, before the breast has broken, the patient complains of rheumatic pains in different parts, especially in the loins and thighs: nutrition is much affected; the countenance assumes a peculiar bad, earthy appearance, the arm of the affected side swells, and can no longer be moved from the body, and death follows, under the symptoms of hectic consumption already described.

This form of cancer of the breast is sometimes developed with a scirrhous inflammation, under which the whole breast swells; or there has been previous long existent hardening, or a milk-knot assumes the scirrhous degeneration.

[Brodie divides "scirrhous tumours of the breast into two classes: one where there is a conversion of the gland of the breast itself into the scirrhous structure, there being no well-defined margin to it; the other, where there is a scirrhous tumour imbedded in what appears to be otherwise a healthy breast, as if it were altogether a new growth, there being a well-defined boundary to it." (p. 195.)

The latter of these, the course of which is above described by CHELIUS, is the ordinary form of *scirrhus;* the former is comparatively rare, and, as far as I have seen, does not pass into ulceration; but the whole gland becomes converted into one hard stony mass, which retains the shape of a plump, well-formed breast. It, in general, grows rapidly, and the glands in the arm-pit soon become affected by the disease, and the patient's powers are worn out by its malignant effect upon the constitution, although it does not ulcerate. I have, very recently, had two cases of this kind under my care, the one I have lost sight of, but the other is slowly sinking under the circumstances I have just mentioned. BRODIE justly observes, that in such cases "the operation not only never succeeds in making a permanent cure, but rather hastens the progress of the disease. The patient dies within two or three years, and probably much sooner, from an effusion of fluid into the cavity of the pleura." (p. 195.) I recollect having a case in which both breasts were affected by this general scirrhous enlargement, in addition to which nearly the whole of the skin covering the front of the chest was closely set with scirrhous tubercles of various size; but, in this case, both breasts and skin ulcerated superficially, and the patient died hectic, about three or four months after the ulceration had taken place.—J. F. S.]

2443. *Scirrhus* of the breast frequently begins with a single lump at one particular part of the gland, and seems to stretch itself by a string-like process, towards the arm-pit. In the increasing enlargement, the whole gland of the breast is changed into a firm, elevated substance; its surface is granular, the skin bluish-red, blackish-red, with a bluish tinge. The tumour quickly adheres to the skin and underlying parts, and stretches towards the glands of the arm-pit, which rarely fail to swell. The ulcer has a dirty bottom, red, hard, outturned edges, and hard knots are felt at various parts in and beneath the skin. The secretion of *ichor* in the sore is considerable, and very ill-smelling; bleedings frequently occur, and death follows, under the above-mentioned symptoms.

2444. Cancer of the breast not unfrequently is developed as *skin-cancer.* A lump, a wart, or a hard little mark appears at some one spot of the skin, which gradually reddens, and with lancinating pain, runs into ulceration. The ulcer spreads, with hard edges and bottom, after the manner of skin-cancer, more on the surface, and little in depth; it, however, extends gradually to the glands. Swelling of the arm-pit glands follows much later than in glandular cancer.

2445. *Cancer of the areola* begins with knot-like swelling of its little glands, which ulcerate; the nipple itself is attacked and destroyed by ulceration. A dusky girdle in the skin surrounds the ulcerated parts; the affected breast is full, round, and elastic; the neighbouring parts remain unaltered. A fungous growth springs up from the ulcerated surface, which is reproduced as soon as destroyed. If these growths be left alone, they form a soft vascular *fungus*, and general disturbance follows, accompanied with throbbing pain in the breast; but if they be destroyed, the irritable condition of the breast ceases. Earlier or later symptoms appear, which show that the constitution has become affected; the patient wastes, has a yellowish, earthy countenance, pains in the back and loins, and often dies, without the breast-gland being considerably affected by the disease.

2446. *Cancer of the nipple* begins with a round swelling at the root of the nipple, which is not painful, but is very hard and irregular on its surface; as it enlarges it becomes the seat of shooting, lancinating pains, which run from the swelling to the shoulder. The nipple ulcerates, is covered with a yellowish crust, which separates and forms afresh; more extensive ulceration follows, the nipple is destroyed, and a scirrhous substance is laid bare. The *scirrhus* spreads widely round the nipple, the pain becomes more violent, but the diseased part is not tender to the touch; a crust is no longer formed; the ulcer secretes ichor, and sometimes bleeds. The glands of the arm-pit swell, and the usual symptoms of hectic consumption close the scene.

According to Astley Cooper (*a*), a fungous degeneration of the nipple begins in the same way. Behind the nipple, and firmly connected with it, a round, less hard swelling than in *scirrhus* forms, which is slightly painful on pressure, but otherwise quite free from pain. Astley Cooper also mentions a swelling behind the nipple, which occupies the space of an inch, occurs commonly between seven and twelve years of age, is more frequent in boys than girls, mostly on one side, rarely on both, is tender, often painful when touched, movable, and over which the skin is unchanged. This swelling is benignant, and yields to dispersing plasters, and the internal use of calomel and rhubarb, and the like.

[Astley Cooper gives the following account of the development of the nipple in the *fœtus*, and of its subsequent changes:—"In both male and female infants a gland exists, which is the *nidus* of the future nipple, over which the skin is puckered into a small projection. This glandular substance lies concealed under the skin until near the age of puberty, and then it gradually evolves and becomes converted into the nipple of the adult. In the male, the tubes through which the milk of the infant passes become ligamentous cords in the nipple of the adult; and in the female, the similar tubes become the lactiferous ducts of the nipple. Thus it is that the *nidus* of the adult nipple is protected until the age of puberty. It is this structure, then, of the male and female nipple, prior to the age of puberty, at the time when the evolution of the nipple is commencing, which produces the swelling to which young people are subject, from the age of eight years to the period of puberty; for when the action is greater than the evolution requires, a hard inflammatory swelling is produced. It is in this structure that, in future years, the *malignant areolar* or *mammillary tumour* forms. Here the scirrhous tubercle commences, which destroys the nipple, and ultimately extinguishes the life of the patient. It is in this structure that the fungous swelling above mentioned is formed. The female is less subject to it than the male, because the mammillary substance is principally absorbed, and lactiferous tubes are formed in its stead." (pp. 453, 454.)

Brodie says:—"A scirrhous tumour may occur in the nipple; and I believe that this may properly be distinguished from a scirrhous tumour of the breast itself, and that there is a greater chance of a permanent cure from an operation where the disease originates in the nipple, than where it originates in the breast." (p. 201).]

2447. The *symptoms* accompanying the development and progress of cancer of the breast are, besides those already noticed, subject to many varieties. A *scirrhus* often exists in the breast for a considerable time without causing any inconvenience; sometimes it is quickly developed, and accompanied with general affection of the constitution, which in other cases only appears at a later period. The transition into ulceration is often the consequence of external violence, and often of the discontinuance of the monthly discharge. Sometimes open cancer is little painful, but generally highly so; and the more severe the pain in *scirrhus* and cancer, the quicker is their progress; hence may be distinguished an *acute* and *chronic* cancer of the breast.

Acute cancer begins as a hard lump, deeply seated in the breast, at first movable, but in one or two months adherent to the skin, which becomes discoloured. The hardness soon affects the whole breast, but only a single part projects much, is shiny, purple red, and elastic, as if it contained fluid. The pain is very violent and shooting, as in whitlow. The gland of the breast does not enlarge regularly, but in separate swellings; the glands of the skin seem enlarged, the surface is beset with little white points, which become more distinct as the tumour becomes of a deeper dusky-red. A trickling begins on the most prominent part, which may lead to the expectation of suppuration, but this does not take place.

(*a*) Lectures, above cited, p. 450.

The *scirrhus* quickly enlarges, with additional redness and increase of pain; the countenance assumes a painful, anxious expression, and the skin a pale-yellow appearance; and great feebleness and depression ensue. The larger lumps in the skin become black, burst, discharge a little blood, and afterwards serum. Unawares the surface sloughs to a great extent, and the breast is deeply hollowed by an irregular ulcer filled with black sloughs, its edges raised and beset with lumps, which burst, discharge, slough, and form deep, foul ulcers. The ulceration spreads by the sloughing of these tubercles, and spreads incessantly, farther and farther.

That kind of breast-cancer is considered *chronic*, which is dry and hard as cartilage; when it has acquired a certain size, it crumples together, so that the swelling presents different clefts from the skin being drawn in and wrinkled, in which the retracted nipple is completely hidden. It is specially observed in old, shrivelled women, with dry, tense fibre. Sometimes these *scirrhi* open by superficial ulceration, which closes again with a scar (*a*). The pain is not very great, and the disease may exist for many years without making any great progress.

["In many cases of scirrhous tumours of the breast, the skin," observes Brodie, "is drawn, or tucked in, over the tumour, so as to produce the appearance of a dimple in it. Where this dimple in the skin exists, you may be almost sure that there is a scirrhous tumour in the breast beneath it, and on examination you will feel it with the finger. * * * But on what does this appearance depend? In a case which I dissected very carefully, I found a narrow process or elongation of the disease, perhaps half an inch in length, passing from the tumour through the *adeps* into the skin, and connecting the skin and the tumour to each other. In fact, the dimple indicates that the disease is not confined to the breast, but that the skin is already contaminated." (pp. 197, 198.)]

2448. The interior of *scirrhus* of the breast is the same as that already generally mentioned. When cut into, it shows an exceedingly hard substance, from the midst of which white streaks radiate, between these and similar connecting streaks, by which a fan or net-like tissue is formed, having deposited between them a soft, lard-like substance; in many instances the tumour forms a large, lardy mass, in which the white streaks are fewer, even entirely wanting, and do not, as in the former instance, spread indefinitely beyond the boundary of the swelling (*par.* 2395.) The relation of these white streaks to the tumour is exceedingly important; in general they stretch much beyond the irregular hard lumps, which can be felt externally. The retraction of the nipple here affords an important character; it is produced by the streaks which originate in the centre of the lump, and spread between the milk-tubes of the nipple. In the same way these streaks stretch beyond the bounds of the gland into the surrounding cellular tissue (*b*).

2449. Various tumours are developed in the breast, the distinction of which from cancer is, in many instances, excessively difficult to the most clever practitioner; and probably on such mistake in the *diagnosis* rest those successful cases, in which the dispersion of presumed *scirrhus* has been effected by the use of internal and external remedies. Such tumours are, *a*, *Inflammatory affection, and painful swelling of the lymphatic vessels*, which run from the breast to the arm-pit; or *swelling of the breast-gland itself*, in consequence of *chronic inflammation*; or *continued swelling*, after *previous inflammation and suppuration*. *β*, *Milk knots or lumps*. *γ*, *Scrofulous swellings*. *δ*, *Herpetic and Psoric affections*,

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(*a*) Dictionn. des Sciences Médicales, vol. iii. p. 555.
(*b*) Charles Bell, above cited, pl. ii. iii.

especially about the nipple. ε, *Encysted tumours.* ζ, *Steatomatous degeneration.* η, *Medullary fungus.* θ, *Blood swellings.* ι, *Hypertrophy.* A careful examination of all the circumstances accompanying the origin of such tumours can alone direct the practitioner in his *diagnosis.*

2450. *Chronic inflammatory affection of the lymphatic vessels, or of the breast-gland*, is specially characterized by it being painful on pressure, which is not the case with *scirrhus.* Chronic abscesses in the breast sometimes form exceedingly slowly, as hard swellings, in which only at a late period, fluctuation is indistinctly felt; but the soft part is always surrounded to a tolerable extent with a hard swelling. It is more readily mistaken as malignant, on account of the general health being always more or less therewith affected. Irritating applications and plasters, opening the swelling, poultices, and general treatment, which improves the constitution, effect the cure. Benignant hardening is commonly observed in young people, most frequently between puberty and the thirtieth year. The swelling is usually superficial, feels as if a lobe of the gland were enlarged, as if several were united into one swelling. It is movable, has no string-like processes towards the shoulder; there is no pain in the breast, shoulder, and arm; no injuring of the general health; no affection of the armpit glands; and it is not so hard as *scirrhus.* The disease is in general sympathetic with the state of the womb, and occurs in unmarried or married women who continue unfruitful. Its *occasional causes*, with previous predisposition from uterine irritation, are often mechanical violence, blows, and the like. The swelling enlarges very slowly, never becomes large, remains long free from pain, and in many cases, only after years, is accompanied with a stabbing, rheumatic pain.

Dispersing remedies, repeated leeching, mercury, hemlock, iodine internally and externally, and means which regulate the functions of the womb and improve the general health, often diminish or entirely dissipate the tumour. But if not, if the swelling increase, its removal is indicated, and on account of its mobility, easy; and it does not return. On examining such tumour, a number of lobes are observed, connected with thick cellular tissue, which, when cut through, look like cow's udder.

After the cessation of menstruation, a swelling of this kind may become malignant; it may also disappear before that period, during pregnancy and suckling, although previously it has resisted all remedies.

2451. In very sensitive persons, between the ages of fifteen and twenty, when menstruation is suppressed, or irregular and scanty, and the whites are present, sometimes, if the breast have received a blow or push, there may be very great tenderness to the touch, with or without swelling of one lobe of the breast-gland, and pain running from the breast to the shoulder and elbow, and not unfrequently to the hand and fingers. Previous to menstruation the swelling is greater, but after it of less size. The sensibility is often so great that restlessness and loss of sleep ensue; the weight of the breast is sometimes unbearable, even in bed, and vomiting occurs with the severity of the pain. The skin of the breast is unaltered, and without a trace of inflammation. Sometimes only a small portion, and at other times the greater part of the breast is affected, and sometimes both breasts may be attacked at once. The *causes* of this condition are always very irritable constitution and disturbed functions of the womb.

Belladonna, opium, extract of hemlock, soap plaster, oiled silk, and the like, are employed locally, and in violent inflammation, leeches. Such internal remedies as diminish the excited sensibility, and regulate the functions of the womb, therefore, calomel and opium, and between whiles a mild aperient, *aqua lauro-cerasi*, or hemlock with rhubarb, should be given; afterwards strengthening remedies, especially the preparations of iron, with a corresponding dietetic regimen (*a*).

[All these remedies and a vast many others are frequently employed without the least benefit, and patient and practitioner are equally tired of the complaint and of each other. Matrimony is the most agreeable and most certain cure for this most vexatious ailment, and should be gently hinted to the patient's friends.—J. F. S.]

2452. *Milk-knots* or *lumps* often present the same hardness as *scirrhus*. They always occur during pregnancy, or after delivery, from whatever cause can produce inflammation of the breast-gland, as, for instance, cold, vexation, fright, mechanical irritation, excoriation of the nipple, and the like. At first there are either symptoms of inflammation, which subside, or there is not any accompanying inconvenience. Besides these circumstances, milk-knots are characterized by their round smooth shape, and by their free mobility; they are generally in the middle of the breast, near the nipple, well defined, not surrounded by any hardened cellular tissue, and not connected by any strings to the neighbouring parts. They always diminish or disapppear on the recurrence of the flow of milk; they diminish in a second pregnancy, and generally lessen when menstruation comes on.

Milk-knots have a malignant appearance in old women who have never been pregnant, if they occur after the cessation of menstruation, if subject to mechanical injury, if connected with gout or other general diseases. The swelling is then harder and more irregular; the cellular tissue becomes hard around the knot and is connected by strings with the neighbouring parts; under such state scirrhous degeneration is always to be presumed (*b*).

To this place belong also those cases produced by suppression of the milk, or by rupture of the milk-tubes, and extravasation of that fluid into the cellular tissue, which form fluctuating tumours, containing a very large quantity of milk. They generally begin soon after delivery, with a swelling, which fluctuates, without previous symptoms of inflammation and suppuration, accompanied with a feel of painful distension, which increases when the child sucks. The swelling arises at any one part of the breast from the nipple to the edge; the cutaneous veins are enlarged; but the part is not discoloured. Scarpa (*c*) saw such a tumour, which occurred during suckling, and from which, with a trocar, he drew off ten pints of pure milk. The introduction of a seton into the cavity, and its gradual lessening by withdrawing some threads, favours the speedy diminution and complete closure of the cavity. In subsequent lyings-in, the secretion of milk in the breast undergoes no alteration.

[The disease just noticed is that named by Astley Cooper, the *Lacteal* or *Lactiferous Swelling*; and though often containing a few spoonfuls of milk, rarely acquires a very considerable size. In 1839 I had a case five weeks after delivery, which was thought very remarkable, as more than a quart of rich, good milk was discharged by a puncture with a lancet. As I was fearful the aperture might close and the milk collect again, a tent of lint was inserted in the wound; but in the course of twelve or fourteen hours she was violently attacked with irritative fever, and when I saw her next day was exceedingly ill. The tent was removed, and immediately a quantity of very fetid air escaped, and about two ounces of stinking milk. She continued very unwell for three or four days, and afterwards the cavity slowly lessened, and she recovered. I should certainly never again, in a like case, introduce any tent, and still less should I be disposed to pass a seton through, as recommended by Chelius; for the cavity having been deprived of its support by the discharge of its contents, is sufficiently

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(*a*) Astley Cooper, Lectures, p. 214.

(*b*) See *par.* 149, and Benedict, above cited.

(*c*) Opuscuoli di Chirurgia, vol. ii.

disposed of itself to inflame, without further excitement. And indeed the Surgeon has sufficient to do to keep the inflammation under; for I have seen, in two or three instances, when a small milk-swelling has been merely punctured, such inflammation occur, that the skin covering it has quickly run into gangrene, and instead of one, three or four holes leading to the cavity, and subsequent troublesome sinuses, and a spoiled breast. The only treatment necessary, is a free puncture and soothing poultices, with purging, to lessen or get rid of the secretion of milk entirely, which keeps up irritation, and by its constant flow prevents the adhesion of the walls of the cavity.—J. F. S.]

2453. *Scrofulous tumours in the breast* may be easily taken for *scirrhus*, and even when they have gone into ulceration they greatly resemble cancerous ulcers. The age of the patient, the general signs of scrofulous disease, and especially the circumstance that usually several, often a very great many, of these little swellings may be felt in the breast, should direct the practitioner.

The *treatment* consists in the employment of anti-scrofulous and such remedies as improve the constitution, regularity of living, and the application of dispersing plasters and rubbing.

2454. *Herpetic and psoric affections* around the nipple can produce swelling of the nipple, and even of part of the breast-gland, and by the spreading of the ulceration, may cause considerable destruction. The origin of the disease, the general state of health, and the above-mentioned (*par.* 153) mode of treatment, are the foundation of the *diagnosis*.

2455. *Encysted tumours* in the cellular tissue of the gland of the breast are often very difficult to distinguish from *scirrhus*, especially when the cyst is very hard and firm. The marks of distinction are, the encysted tumour has no string-like connexions as *scirrhus* has, it is more defined, rounder, firm and elastic, or distinctly fluctuating, according to the thickness of the cyst. If the cyst be thin, and the tumour near the skin, the latter has a bluish colour. The general health remains undisturbed; the swelling is free from pain, unless there be any disposition to suppuration in the sac. When the fluid is emptied it is transparent as water, with a slightly-yellow colour. The walls of the cavity often consist of a pretty thick fibrous capsule, on the inner surface of which are red fungous excrescences of different size.

Only large tumours of this kind need extirpation; smaller ones, with a thin cyst, may be punctured, and by the introduction of a slip of linen, adhesive inflammation, and adhesion of the sac, or its throwing off by suppuration, may be effected (*a*).

2456. I consider that state of the breast-gland, commonly known as *vesicular scirrhus*, or *carcinoma mammæ hydatides*, as a steatomatous degeneration of the gland. The breast-gland, in such cases, forms a very projecting tumour, the greater diameter of which is not at the base, where it is connected with the chest, but at some distance from it. The form of this swelling is not globular, but quadrangular, at some parts more, at others less prominent. The nipple is not drawn in, but prominent, and of the natural appearance. At some parts the swelling feels hard, at others tense and elastic, and even distinctly fluctuating. The veins on the surface are larger, the swelling movable in every direction. It may acquire enormous size, and exist many years before it bursts or reaches the arm-pit glands. In one case which I saw in an unmarried person, thirty years old, neither one nor the other had happened. The swelling can easily be separated. The result of the operation is favour-

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(*a*) Chelius; in Heidelb. Medic. Annalen, vol. i.

able, if, in course of time, it have not passed into scirrhous degeneration. On examining the tumour, it is found to consist of large and small cavities, upon the unequal size of which the irregular shape of the tumour depends, which are filled with serous, gelatinous, more or less bloody fluid, or with a lard-like substance, the walls of which are of different thickness, and even of a cartilaginous nature.

Astley Cooper distinguishes several kinds of hydatid swellings of the breast. "*The first* species of this disease exists in the form of simple bags, which contain a serous fluid. I should call them *cellulous hydatids;* and the symptoms which they produce are as follows:—The breast gradually swells, and in the beginning is entirely free from pain or tenderness; it becomes hard, and no fluctuation can then be discovered in it; it continues slowly growing for months, and even for years, sometimes acquiring very considerable magnitude, the largest I have seen having weighed nine pounds; but, in other cases, although the bosom was quite filled with these bags, yet it never exceeded twice the size of the other breast. At first the swelling feels entirely solid, so that it bears a great resemblance to a simple chronic enlargement of the breast; but, after a great length of time, a fluctuation can, at one part, be discovered in it, and then the breast begins to increase more quickly; and, in several parts, similar fluctuations can be detected. The cutaneous veins become varicose; but, although the breast is eminently enlarged, it still continues almost entirely free from pain; but to this there are exceptions. * * * At length one of the fluctuating portions of the breast slowly inflames, ulcerates, and discharges a large quantity of serum, or of a fluid having its general character, but of a consistence somewhat more glairy; and the sac being emptied, and the external opening closed, if the fluid be entirely discharged, it is a long time before it re-accumulates; and sometimes the sides of the sac adhere, and the cyst ceases to secrete. In other instances I have known the swelling break and discharge a mucilaginous fluid mixed with serum; and several of the cells in succession, and at distant periods, pass through the ulcerative process, and form sinuses which are very difficult to heal. Excepting during the process of ulceration, the general health remains entirely undisturbed, and the person suffers so little, either locally or constitutionally, that her friends do not discover her malady; and nothing would lead her to consent to an operation for its removal but the anxiety of mind and the apprehension which the idea of a cancer produces, and the great inconvenience and distress which the weight of a large swelling occasions * * * It is found, upon a careful dissection, that the interstices of the glandular structure itself, and the tendinous and cellular tissue connecting it, are, in a great measure, filled with fibrous matter, poured out by a peculiar species of chronic inflammation; but, in some of the interstices, a bag is formed, into which a serous, or glairy, or sometimes a mucous fluid, is secreted, according to the degree of inflammation attending it; and this fluid, from its viscidity, and from the solid effusion which surrounds it, as well as from the cyst being a perfect bag, cannot escape into the surrounding tissue. * * * Vast numbers of these cysts are found to occupy each part of the breast, producing and supporting a continued but slow irritation, and occasioning an effusion of fibrous matter, by which the breast forms an immense tumour, consisting of solid and fluid matter. Within these bags of fluid, hydatids, hanging by small stalks * * * had a cellular tissue within them, in which a fluid was collected, which, although it produced the appearance of cells, or hydatids, on the outside, within assumed the character of anasarcous swellings. * * * This disease, in its first stage, resembles simple chronic inflammation, but may be distinguished from it by the absence of tenderness upon pressure, and the perfect health in which the patient remains, stamps it to be an entirely local disease. In the second stage, when it fluctuates, it is discriminated by observing several distinct seats of fluctuation, and by the absence of tenderness; but the best criterion is the puncture of the bag, when the evacuation of a clear serum, instead of a purulent fluid, at once teaches the true nature of the disease. From a scirrhous tubercle it may be distinguished, by the absence of those occasional acute and darting pains which accompany that malignant affection, by the preservation of health, and by the excessive hardness, which are concomitants of *scirrhus.*" (p. 20–25.) A further peculiarity of this disease is, that it does not attack other parts by absorption, nor has Astley Cooper seen it in both breasts.

The *treatment* consists in puncturing it, if there be only one large cyst, and in its extirpation, when the whole breast is affected; in doing which all the hardness must be removed to prevent the return of the complaint.

Second. "The breast was, in this case, enlarged, and, in the greater part, hardened, by the effusion of fibrin, (coagulable lymph,) in lobes, into the cellular tissue; but, in several parts, it contained bags of serum, and formed fluctuating cysts of various sizes. In each of these cells there hung a cluster of swellings, like *polypi*, supported by a small stalk; and the little pendulous projections appeared to float in the fluid which had been produced around them, in the different cysts. Many hydatids were found in a detached state, both in the fluid within the bags, and in the solid effusion in the breast; and taking the whole tumour, vast numbers of them had been formed in it. Their size varied, but the largest did not much exceed that of a barleycorn, the figure of which they assumed. In general they were of an oval form, or, I ought to say, oviform, as they were larger at one end than the other. When opened, they were found to be composed of numerous *lamellæ*, like the crystalline humour of the eye, or like the layers in the onion, which could be readily peeled from each other." (p. 40.) "It is doubtful if these structures are not of the nature of globular hydatids, and which have perished from the pressure of solid matter with which they are surrounded; or, whether they are productions or secretions of the arteries of the part." (p. 41.) They are rare, and extirpation is the only remedy.

Third. "The *globular hydatid* is contained in a cyst formed in the breast, by the adhesive process; for wherever it is deposited, it excites irritation, and becomes surrounded and encased by an effusion of fibrin which is highly vascular; and its internal and secreting surface is directly applied to that of the hydatid, and a slight moisture exists between them, they having no vascular connexion. In the breast I have only seen them exist singly, but, in other parts of the body, great numbers are found. It is a semi-diaphanous bag filled by a clear water, and it is uniformly smooth on its external surface. It has no opening or inlet, so that it must derive its nourishment by absorption from its external surface. It is composed of two coats; the external is of considerable density, and if any opaque body be placed behind it, it has the shining appearance of mother of pearl, and reflects the rays of light from its surface. It possesses a considerable share of elasticity, and rolls itself up when it is broken. This external layer is lined by a very delicate internal membrane, which appears to be its *uterus;* for, from its interior, a multitude of small hydatids grow, which, at first, adhere to the membrane, but afterwards become detached, from its falling into the fluid which the hydatid contains. If, therefore, the fluid-contents of the hydatid be collected in a glass, an immense number of small hydatids will be discovered floating in them. * * * I am induced to believe them to be distinct animals: first, because they have an existence and growth of their own, having no vascular connexion with the part in which they are found, but being only encased and surrounded by a vascular and secreting cyst; secondly, because they have the power of producing upon their interior surface their own species. * * * When one of these hydatids is produced in the breast, an inflammation is excited by it, and a wall of fibrin surrounds it; it feels hard, and from the small size of the hydatid, a fluctuation cannot be discovered; but as the hydatid grows, although the quantity of solid matter increases, yet as the fluid in the hydatid becomes more abundant, a fluctuation in the centre of the tumour may be ultimately perceived. Sometimes, when the hydatid has considerably enlarged, it produces a suppurative inflammation; and when the matter is discharged, either by the lancet, or by ulceration, the hydatid escapes at the opening." (p. 47-49.)

[BRODIE (*a*) appears to me to have described ASTLEY COOPER's former two kinds of hydatid tumours under the name of *Serocystic Tumour of the Female Breast.* With COOPER, he agrees that "it does not contaminate either the skin or the lymphatic glands; it is not complicated with any correspondent disease of the *viscera*, and all the experience which I have had justifies the conclusion, that if care be taken that no portion of the breast be allowed to remain, we need not be apprehensive of its recurrence. (p. 154.) It is undoubtedly not malignant in the proper acceptation of the term. It may go on to inflammation and ulceration. and the ulcer may spread, and slough, and bleed, but it does not contaminate the constitution. Still I am not prepared to say that it may not, under certain circumstances, and in peculiar constitutions, assume a malignant character; this being no more than may happen to almost any morbid growth." (p. 156.)]

The *treatment* consists in cutting into and cleaning the cyst, or in the introduction of a seton.

This latter form only seems to admit of being held as a peculiar state of disease, as in the others as well as in scirrhous degeneration, the formation of larger and smaller

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(*a*) Lectures illustrative of various subjects in Pathology and Surgery.

cysts and sacs must be considered as accidental, and resulting from the distension of certain cells.

2457. *Medullary fungus* is developed either in the breast-gland itself, or between it and the armpit, as a roundish swelling of which the hardness is not so great as in *scirrhus*, and the surface is more regular. In its further growth the tumour softens; the skin covering it, is at first natural, but afterwards becomes livid; the veins swell considerably; the surface of the skin assumes an inflamed appearance, and the swelling shows evident fluctuation. The pain is less than in *scirrhus*; the armpit-glands swell more rarely; the nipple is not drawn in, and the skin has not the puckered appearance as if covered with scars. When the tumour opens, it discharges a bloody fluid; a *fungus* soon sprouts from the opening and bleeds readily; a stinking ichor is secreted in great quantity. Its progress and reaction upon the whole body is generally quicker than in cancer. This medullary *fungus* shows itself at all times of life, but it is most common after the thirtieth year.

2458. The *blood-swelling* of the female breast begins with a gradual and moderate tumour of the breast, which in delicate women is not unlike the distension and fulness which occur during menstruation, though greater, and attended with more uneasy and continued sensibility. By degrees a superficial hardness is noticed; the disease, however, rarely remains in this state more than a few days; its extent gradually increases till all the neighbouring parts have a feel of softness. In the midst soon arises an isolated, small, but not hard swelling, nearly at the part where at first the breast, on slight pressure with the finger, was more sensible. This first stage has an indefinite period, two, three, six, or twelve months, during which the symptoms, after subsiding, occasionally again seem to recommence. The swelling feels like a small conical or egg-shaped body, which is not so distinct from the surrounding parts that it can be easily twisted by the fingers; it, however, is so loosely connected that it can be pushed from side to side. The skin is neither red nor warm; the parts immediately about the swelling suffer dull pain, and sometimes an actual numbness. The tumour is somewhat superficial, and at the same time causes a feel as if there were some soft body between it and the skin, which can be moved about upon it. The duration of this second stage also varies; the increase of the swelling may be for years scarcely perceptible, but circumstances may operate which may effect this in months. Sometimes the tumour enlarges, but after a time resumes its previous condition; and whilst growing, it always retains a rounded form. A diseased condition of the veins is probably the foundation of this complaint, in consequence of which, either from repeated congestion, or from the effect of external violence, there is an outpouring of blood into the cellular tissue, and a pretty firm tumour is formed.

In its *treatment* the general state of the health must be carefully attended to. In the first stage, leeches, dispersing applications and purgatives, must be employed; in the second, moderate pressure, and careful evacuation of the blood by puncture. Shelling out the sac and removal of the breast are usually superfluous (*a*).

(*a*) Monro, A., M.D., Histories of Collections of bloody lymph in Cancerous Breasts; in Edinburgh Medical Essays and Observations, vol. v. p. 337. 1747.—Richter. Observationes Chirurgicæ, pl. i.—Rodmann, J.; in Edinb. Med. and Surg. Journal, vol. xxx. p. 1. 1828.

In consequence of a considerable determination of blood to the breast in girls under twenty-two years of age, there has been noticed, a few days previous to menstruation, a *vibex* or a broad streak, as of extravasated blood, with great sensibility and pain, which gradually spreads over the arm to the fingers. Sometimes this *ecchymosis* disappears a week after menstruation, but recurs more or less regularly with it. In severe cases it remains till the next menstruation. It is not dangerous, but indicates the necessity of regulating the functions of the womb. The best dispersive is the application of acetated liquor of ammonia with spirits of wine (ASTLEY COOPER.)

Here, also, must be noticed, the *weeping of a yellowish-white or bloody fluid from the nipple,* which sometimes appears only at the menstrual period, but at other times continues still longer, accompanied with swelling of the whole breast, sometimes also with several swellings in the breast-gland, and sometimes with dragging pains. I have hitherto seen it only in unfruitful women, or in those who are childless, towards the cessation of menstruation. With regular living and abstinence from all sexual excitement I have noticed this discharge, which had continued after the *menses* had ceased, gradually subside. Only in a single case, after the quick subsidence of the discharge from the nipple, was a scirrhous swelling of the breast-gland produced. PIGNÉ observed a like case in a man, fifty years old, in whom from four years of age there had been regularly every month a discharge of bloody, watery fluid from the nipple, which was more copious in spring and autumn. After sudden subsidence of this discharge, a hard regular tumour as large as a pigeon's egg was produced, which soon became the seat of lancinating pain. The patient was well for six months after the operation; but then the scar burst, a cancerous ulcer formed with swelling of the armpit-glands, and death ensued after some months. On dissection, all the bones were found softened, very flexible, and easily cut through with the knife as is often observed in cancerous dyscrasy.

2459. *Hypertrophy of the female breast* is characterized by a regular and painless increase of substance, which is produced either suddenly at the period of development, or more slowly at a later period. Sometimes only one, at other times both breasts are affected at once, and may attain very considerable size and weight, from ten to twelve pounds. At first there appears, without any change of colour in the skin, great tension, but afterwards with considerable increase of size, a soft condition, and only when the finger is pressed in deeply, are the enlarged and hardened *acini* of the breast-gland felt. When this hypertrophy occurs in later years, it may exist for a long while without any general affection and without any other inconvenience than its weight, as I have in some cases observed, in otherwise healthy and blooming women. If it occur at the period of development, it generally begins in the right breast, rarely in both at once, with a feel of prickling or increased sensibility; menstruation is either wanting entirely, or sparing, and irregular; but every time it appears, the above-mentioned symptoms increase, and the breast suddenly enlarges. Frequently the voice at the same time undergoes some alteration, it becomes rough and hoarse; this continues often only a few days during menstruation, subsides and returns without any cause being discovered. In gradual enlargement of the breast, the nipple becomes flatter and broader, its *areola* larger; the swelling, at first rather tense, softens, and only when the finger is pressed in deeply are the enlarged and hardened *acini* felt. When the swelling has acquired considerable size, the veins of the skin swell, in consequence of which it has a bluish appearance, although the colour of the skin itself is unaltered. The swelling now either remains stationary, and may continue a long while, even during the whole life, without any further influence on the general health; or there may occur in the hypertrophic organ further connexions, outpourings, encysted tumours and the like; or there may be with symptoms of affection of the air-passages and lungs, dry cough, sometimes frothy, sometimes streaked with blood, difficult breathing, *hydrothorax*, hectic fever and death.

2460. On anatomical examination of hypertrophic breast-gland, there is found besides the increase of substance and enlargement of some *acini*, no other variation from the natural structure. More fat is collected in the loose cellular tissue; the arteries are unchanged; the nerves indeed, not smaller and thinner, though backward in comparison with the size of the breast-gland; the veins are always much distended, and their structure changed, and the milk-vessels swollen and enlarged.

2461. The cause of this hypertrophy during the period of development is always the sympathetic relation of the breast with the internal generative organs, which may be increased by various causes, as the use of irritating exciting food and drink, irritation of the breast by feeling it, by libidinous excitement, by washing and rubbing with irritating substances and the like. At a later period of life, however, I have noticed this hypertrophy in women, in whom the functions of the womb were quite regular, and no further cause could be discovered.

2462. The object of the *treatment* is either the diminution of the excessive formative activity, or the removal of the gland with the knife. The former mode of treatment, which can only have a satisfactory result, in the beginning of the disease, when at the time of menstruation, a prickling feel in the breast, or its increase of bulk occurs, requires, especially in full-blooded persons, and congestion of the breasts, bleeding from the feet, and internally, nitre with camphor, vegetable and spare diet, and the avoidance of those influences which may excite the living activity of the affected part. With greater swelling, iodine, burnt sponge with *digitalis*, rubbing in ointments of iodide of potash or of mercury, and the application of cloths smeared with camphor, leeching from time to time, and continued pressure. After three or four weeks a pause may be made, when the patient may live a little better, and then the previous treatment may be resumed. The internal use of extract of hemlock in increasing doses, and the application of camphorated hemlock plasters, I have found, after previous antiphlogistic treatment, do good service. On the failure of these means, FINGERHUTH (*a*) has seen great effect from exciting the breast-gland to action by constant application of a milk-glass, or of a cupping glass, as although the swelling is thereby at first increased, the dragging and tense feel subsides, and in the course of some weeks the enlargement ceases with the appearance of secretion of the milk.

If, in spite of this treatment, the enlargement of the breast proceeds, and if the constitution be affected, the removal of the breast is the only remedy, and if the patient will not submit to it, the breast must be supported with a suspender, attending at the same time to the secretions and excretions, moderate diet, and exercise in the open air.

2463. That which has been already mentioned generally, applies to the ætiology of *scirrhus* of the breast. Its causes may be internal or external. In many instances it occurs without any manifest cause, and the origin of the irritation of the breast may, perhaps, in many cases, be founded on the sympathetic relations existing between the breast and the womb. Hence *scirrhus* most commonly appears at the period of decrepitude, in unfruitful women, in whom the functions of the womb have never been properly

(*a*) Ueber Hypertrophie der Brüste; in Hamburger Zeitschrift, vol. iii. p. 159. 1836.

performed; hence sometimes hardening of the breast remains for a long while without any inconvenience till the time when the menstrual function begins to be disturbed, on which the passage into ulceration quickly takes place.

2464. The *prognosis* of *scirrhus* of the breast rests on the general circumstances above mentioned. The only remedy is its removal, and the earlier this is done, the better the constitution, and if menstruation be still regular, the more favourable may the result be expected to be. Where the *scirrhus* is already in the state of concealed cancer, the nipple much drawn in, the skin less free and movable, the general health affected, menstruation irregular or entirely ceased, the result of the operation is indeed doubly doubtful; it is, however, the only remedy to prevent certain breaking. If the *scirrhus* be already ulcerated, if it be immovably connected with all the pectoral muscles, if there be also hardening of other organs, no cure is indeed to be expected from the operation; it may, however, in so far, in such case, be considered as a palliative, as the patient is at least free from the great inconvenience attendant on the destruction of a scirrhous tumour by ulceration. I have not noticed a quicker progress of the disease after the operation, but on the contrary, considerable relief for a long while. The operation is easy when there is only a single movable knot to be taken away, but more difficult when the swollen armpit-glands have to be removed, which also render the *prognosis* more unfavourable. It is self-evident that the general circumstances already mentioned, which contraindicate the operation for cancer apply here also. It must not be overlooked in deciding upon the removal of a scirrhous breast, that in the cases where cancer has been very slowly developed and accompanied with no great pain, that after the operation the ulceration again proceeds even quickly, and thus the operation only hastens the fatal result. Before the operation is performed, an issue should be made in the arm of the affected side, and allowed to discharge properly, and the generally irregular state of the alimentary canal should be put right.

[The question as to the propriety of removing a scirrhous breast is most important; and one about which there has been great difference of opinion. Brodie states that "the late Mr. Cline, sen., and Sir Everard Home, both men of great experience and sound judgment, would scarcely ever consent to the removal of a scirrhous tumour of the breast under any circumstances; whereas, he has known other very experienced Surgeons who were in favour of an operation, even in the great majority of cases. And, not only has there been this difference of opinion between different individuals, but he has known the opinion of the same individual to differ at different periods."—(p. 193.) Proof sufficient this to show the importance of reviewing carefully this point of practice.

The general recurrence of cancer after the operation, as more especially shown by Leroy d'Étiolle's statistics, has been already mentioned (*par.* 2408 *note*); let us now see how it applies to cancer in the breast.

Having a vague recollection of hearing Sir Astley Cooper mention the very small number of cases in which cancer of the breast did not recur after the numerous operations he had performed for its extirpation, I took the opportunity of inquiring of my friend Bransby Cooper, whether he could afford me any positive information of his uncle's experience on this point. His reply is:—"I cannot find anything relating to the query you put to me, respecting the statistics of his (Sir Astley's) success, but have a recollection of something like your own impression, that he acknowledged not more than nine or ten out of the hundred extirpations he had performed did not return, and generally within three years at farthest."

Brodie says:—"In the larger proportion of cases in which the operation is performed, the patient is not alive two or three years afterwards; and in a great many cases, instead of the operation stopping the disease, it actually seems to hasten its progress." (p. 192.) This statement fully bears out that of Leroy d'Étiolles.

Brodie then at length proceeds to mention the circumstances under which scirrhous tumours are not likely to be cured by operation, and in which, therefore, it is improper; and these are briefly pointed out by his enumeration of the conditions suitable for the operation, in his reply to the question, "What are the cases, then, in which the removal of the breast is proper?"

"Where, on careful examination, no appearance of disease can be detected in the skin; where there is no dimple in the skin over the tumour; where there is no diseased gland in the *axilla;* where there is no sign of internal mischief; where there is no adhesion of the breast to the parts below; and where the patient is not very much advanced in life;—in a case where this fortunate combination of circumstances exists, we may presume that there is a reasonable chance of an operation being successful. Still, I must not be misunderstood, as saying, that in every one of such cases there will be a permanent cure; nor do I say more than this, that the chance of a cure is sufficient to warrant you in recommending the patient to submit to an operation; and that I have the satisfaction of knowing several persons on whom I have performed the operation under these circumstances, who are now alive and well, and who, otherwise, would certainly have been dead long ago." (pp. 199, 200.) He then mentions two cases; in the one, the patient was operated on fourteen, and the other thirteen years since, and both are at present (1845) in good health. Bransby Cooper informs me, that he had "removed the undoubted-malignant breast of Mrs. ———, and it was eleven years and half before it returned in the cicatrix, and then killed her." In the summer of 1836, I removed a scirrhous tumour in the breast from a woman of sixty-one years of age, its size that of a small bean, which had been discovered only two months. In this case there has been no recurrence of the disease, and the woman has been and still is in good health.

The most remarkable case, however, of which I am aware is one operated on by my friend Callaway, and this woman was not destroyed by the disease till twenty-two years after the operation.

Notwithstanding these few favourable instances, Surgeons should be cautious in urging a patient to submit to an operation for a scirrhous tumour, and still less, when it has become a cancerous sore, and the neighbouring glands in either case have become affected. He cannot promise a cure by the operation; nor can he even say, that the patient's condition will not be made worse. I have often heard it stated, that though the operation will not cure, it will put off the evil day, and retard the ulcerative process; but this I do not believe, for I have known many instances to the contrary. The only thing that an operation can do, is temporary palliation, if the patient be subject to severe shooting, stabbing pain, which is not indeed very commonly the case, unless the disease be worried by local attempts to cure. The practitioner ought, when consulted under these circumstances, to break to the patient cautiously the nature of her complaint; should inform her that all which can be done by operation is at best merely palliative; and should leave her to decide upon whether she will yield herself to the operation, knowing the risk and the slender hope connected with it; rather than urge her to an operation which is without doubt, as regards scirrhous swellings, the most unsatisfactory in the whole course of surgical practice.—J. F. S.]

2465. The removal of a scirrhous breast is effected either by *extirpation*, leaving, however, a sufficient quantity of skin to cover the wound, or by *amputation*, that is, taking off the tumour at its base.

2466. *Extirpation* of the scirrhous breast is generally performed in the same way as the removal of an encysted tumour. The patient lies upon a table (1), or is seated in a chair, and whilst an assistant makes the skin tight, the operator makes two cuts extending from the breast-bone towards the shoulder, which should include the nipple and a large portion of skin, so that the two folds of skin should be sufficient after the operation to cover the wound. The lower flap of skin must be separated from the swelling, which is then to be taken hold of with the fingers or with a hook, lifted up, separated from the pectoral muscle, and afterwards from the upper flap from within outwards, or from without inwards; and water is to be sprinkled on the wound to keep it clear of blood. The bleeding vessels must during the operation, be compressed by the fingers of the assistants, and after its completion, tied (2). The wound must then be cleansed, carefully examined, and every diseased part seized with the hook or forceps, and removed. The edges of the wound are to be brought into perfect contact, and fastened with sticking plaster, lint and compresses applied, and the whole supported with a broad breast-bandage (3). The after-treatment is according to the ordinary rules.

[(1) The horizontal posture on a table is preferable to sitting in a chair, because the patient can be more completely steadied, and also because there is much less chance of her fainting; for if, as sometimes happens, there be a large escape of blood, she faints so completely that the operation must be delayed till she be restored.

(2) If the scirrhous tumour involve the whole breast, and be very large, with full swelling veins, the operator must carefully look to the bleeding, and I think, tie at once either arteries or veins, which may pour freely, as in a very few minutes very serious and even fatal consequences may ensue; of such a case I have a very painful recollection. I operated many years since upon an elderly woman who had an enormously large scirrhous breast, and the veins of the skin covering it were much swollen. Before the operation I feared there would be severe bleeding, and proposed taking up the vessels as they were cut through during the course of the operation, but this was overruled, and pressure with the fingers was determined on, leaving the vessels to be tied after the operation. The bleeding was terrific, and poured from so many veins that it was not possible to grasp and close them. The operation was not tedious, but I had hardly removed the swelling before the woman had died. A lesson not to be forgotten.

(3) The less dressing the wound of the operation is subjected to the better; and it is certainly advantageous not to dress it immediately, for many little vessels which have ceased bleeding whilst exposed, and the patient is faintish, burst forth, often furiously, when the wound has been brought together at once, and the patient gets warm and has the circulation restored, so that in the course of two or three hours, the whole cavity formed by the removal of the breast, becomes distended with blood, and then the bleeding makes its way through the plaster, the patient is drenched in blood, and instances have not been wanting in which her life has been lost in consequence. It is, therefore, better always to leave the wound open for a few hours, and lightly covered with merely a piece of linen, not lint, the fluff of which sticks to the wound, and cannot be got off without great difficulty, and indeed not then even completely, so that it prevents adhesion, and is only thrown off by the establishment of suppuration, which is not desired. Neither is the linen to be jammed and kneaded into every crack and cranny of the wound, and left there for hours, as if it be, the adhesive matter soon glues it fast to the surface of the wound, and it can only be removed with great difficulty and pain to the patient, which is quite unnecessary. The linen is merely to be moistened with cold water, laid lightly over the wound, and replaced every ten minutes, or thereabouts, till the bleeding ceases. Any vessels which bleed, must be taken up as they are found, and after four or six hours, the edges of the wound must be gently drawn together, and retained in place by long strips of plaster, which should be half an inch apart, to allow the escape of the serum as it separates. A wet piece of linen may also be advantageously laid over the strapping, and repeatedly changed, which quiets the arterial action of the part, and keeps down inflammation. I never put on compress or bandage at the first dressing. With this mode of treatment, the wound rarely requires dressing before the fourth or fifth day, when a poultice should be applied for a few hours, to soften the strapping, and facilitate its removal. If soon after the operation the breast become tender and inflamed, a light bread and water poultice, without disturbing the dressing, is very grateful to the patient's feelings, and encourages suppuration at any parts disposed to that process, after which the inflammation quickly subsides. The principal use of a roller round the chest is to keep the skin close to the muscle beneath, so as to prevent the pus bagging, if the two surfaces have not completely united; and under such circumstances, compresses may also be requisite at any period of the healing of the wound. But as a general rule, the lighter and less the dressing is, the better the case proceeds.—J. F. S.]

2467. In *amputation of the breast*, the skin must be divided by two cuts carried around the base of the tumour, which must be detached from the pectoral muscle from below upwards. This method is at least more sure to save the skin than removing the swelling, by one or more strokes with an amputating-knife, or than by the method recommended by

Galenzovsky, of drawing the knife upwards (*a*). When the vessels have been tied, the wound must be filled with lint, and this fastened with sticking plaster and a bandage. When the granulations have risen equally over the wound, its edges must be attempted to be drawn together with sticking plaster, to favour their scarring. The wound should be dressed only with lint, without digestive or other applications, and only towards the end of the treatment, with narcotico-balsamic ointment.

Benedict (*b*) considers moistening the wound with tincture of opium, and a dressing of opium ointment, as the best means to prevent return of the disease. Experience, however, speaks as little in favour of this practice as for the transplantation of a flap of skin, recommended by others.

[I do not think amputation is to be preferred to extirpation of the scirrhous breast, unless it be so large, or the skin so extensively diseased, that it cannot be avoided. But I have seen amputation occasionally performed, and it is remarkable how quickly and how completely a large wound thus made fills and draws together; but what the issue of such cases has been I do not know.—J. F. S.]

2468. Opinions vary as to the preference of extirpation or amputation, as well, also, as to healing the wound by quick union, or by suppuration and granulation. Extirpation and quick union are generally held to be the most preferable mode of treatment, because the cure is thereby effected most quickly, a regular scar is formed, and the wound is not so long subject to irritation as in suppuration, which, under existing disposition, more readily leads to scirrhous degeneration. But it is supposed that, as the ligamentous white strings so commonly extend in the cellular tissue beneath the skin, beyond the bounds of the tumour, and even are still left by the most cautious extirpation, amputation must have the preference, at least when the skin, though only at some spots, is not quite movable, or even degenerated, and the nipple much drawn in. That recurrence of the disease is more ready from the irritation accompanying the cure of the wound by suppuration, I must from experience deny; as I have certainly seen, by this plan of treatment, with simple and proper management of the wound, more successful results than after extirpation and quick union.

After the removal of the scirrhous breast, the surface should always be carefully examined and considered, whether it be covered with a layer of healthy cellular tissue, or whether there be any trace of the divided ligamentous strings remaining, under which circumstance the still remaining parts must be taken away with the greatest care.

2469. Swollen armpit-glands, if superficial and movable, may sometimes be removed; for which purpose a hook is thrust into the outer corner of the wound, and the gland drawn forth. This, however, is never advisable; it is best to lengthen the cut from the outer corner of the wound into the armpit, because there are, in most cases, stringy hardenings along the edge, and even under the great pectoral muscle, which must be removed. The vessels are to be tied as the gland is shelled out. If the seat of the gland be so deep, that it cannot be extirpated without danger of wounding the vessels, the gland must be separated as near as possible to its base, pulled forcibly down, and a ligature put around it.

When the armpit-glands are swollen they must be removed, although in many cases the swelling is benignant, and seems to be merely sympathetic (*c*).

2470. Separate and movable lumps in the breast may be managed with

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(*a*) von Graefe's und von Walther's Journal, vol. xii. p. 606.

(*b*) Above cited.

(*c*) Klein, Chirurgische Beobachtungen, p. 26[illegible].

a simple cut, and shelled out. Though most practitioners give the better advice of removing the whole breast.

If the cancerous degeneration have extended to the ribs and *pleura*, the diseased parts should, according to Richerand (*a*), be cut out.

2471. If the wound do not close perfectly, if several parts have an ill appearance, or if a scirrhous swelling spring afresh from the scar, it must either be destroyed by caustic, or still better, be removed with the knife.

When the wound has scarred, it should be covered with a soft rabbit's skin, the patient's mode of living attended to, and issues kept up.

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Biener, Dissertatio de Exstirpatione Penis per ligaturam. Lipsiæ, 1816.

Dzondi; in Beiträge zur Vollkommung der Heilkunde, vol. i. Halle, 1815.

2472. *Cancer of the Penis* begins almost always on the *glans* or on the prepuce, in a hard knot or wart, generally at first unaccompanied with pain, but when it is irritated, or of its own accord it becomes painful, and runs into ulceration, which is accompanied with an ichorous, stinking discharge, and with a hard swelling of the neighbouring parts. The *urethra* is often destroyed at different parts, and the urine flows from many openings; the neighbouring glands in the groin are affected. Persons who have the prepuce long, and a collection of cheesy matter upon the *glans* from want of cleanliness, are most frequently attacked with cancerous degeneration; and the prepuce inflames, excoriates, swells, thickens, and narrows still more. Ulceration increases on account of the difficulty in passing the water; the aperture of the prepuce sometimes closes completely, and the urine flows through several openings in the destroyed prepuce, which may often be degenerated to a great extent before the disease ha attacked the *glans*. In aged persons cancer most commonly begins, in th way just mentioned, upon the prepuce, because, by the retraction an wasting of the *penis*, the orifice of the prepuce is more influenced by th discharge of the urine.

The *diagnosis* of cancer of the *penis* requires the greater care, as no unfrequently syphilitic ulcers assume a cancerous appearance, with fungou growths, hard out-turned edges, and lancinating pains, accompanied wit swelling of the neighbouring glands; in which case only the ordinary mercurial treatment, in connexion with sedative remedies, is requisite (*b*)

2473. When the disease has arisen from a narrow prepuce and want o cleanliness, in the early period further destruction may be prevented b purifying injections, by softening poultices, by drawing off the urine wit

(*a*) Histoire d'une Resection des Côtes et de la Pleure. Paris, 1818.—Nicod, Dissert. sur le danger de la Resection des Côtes et de l'Excision de l Pleure dans les Maladies Cancéreuses. Paris, 1818

(*b*) See my Bericht über die Einrichtung der chirurg. Klinik, u. s. w.

a catheter constantly worn, or by the operation for *phimosis* (*a*). If the warty excrescence have a neck, it may sometimes be easily removed from the base. Sometimes the cancer only attacks the prepuce, without the *glans* itself being affected, under which circumstance the removal of the prepuce is sufficient. If the cancer be already on the *glans*, and spread further, amputation of the *penis* is the only remedy. This operation is in general more successful than the removal of cancer from other parts, but an important point is, that the testicles, the skin about the *pubes*, and the inguinal glands should be free from hardening.

[The observations I have made as to the recurrence of this disease certainly do not confirm CHELIUS's statement of the successful result of amputation of the *penis*, even in the early stage, as the disease almost invariably returns. I remember one very remarkable case, in which, under favourable circumstances, the younger CLINE removed the *whole penis* as low down as the membranous part; by detaching it as far as possible from the pubic bones in front of the *scrotum*, and then making a cut into the *perinæum*, he turned the *penis* down through it, and completely scraped off the *crura* to their very origins from the bones, and removed them and the bulb, leaving only the membranous part of the *penis*; but the wound in a few weeks took on a cancerous disposition, spread quickly, and destroyed the patient probably quicker than if he had been left alone.—J. F. S.]

2474. Amputation of the *penis* is performed either by the knife or by a ligature. Previous to the operation the *glans* should be carefully examined, to ascertain whether the prepuce alone be affected. As much as possible of the *penis* should always be preserved, as thereby the discharge of the urine is rendered easy, and even connexion itself is still possible.

2475. Amputation of the *penis* by the knife varies, as it is performed near the hinder part of the *glans*, or in the middle, or at the root of the *penis*.

2476. In *amputation of the glans alone or near its hind part*, an assistant grasps the *penis*, behind the diseased part, with his thumb and finger, and draws the skin back. The operator then takes hold of the fore part of the *penis*, which should be wrapped in linen, draws it a little towards him and cuts it off at a stroke with a small amputating knife through the healthy part. The bleeding vessels are then to be tied, and the weeping of the blood from the spongy bodies stanched with cold water, and after the wound has been cleansed, a silver catheter or piece of elastic catheter is to be introduced into the *urethra*, and the edges of the wound closed from above downwards with sticking plaster. Some wads of lint are then to be put over it, and a Maltese cross bandage fastened over it with a narrow bandage. The tube in the *urethra* must be fixed by tapes through its eyes.

2477. If the *penis be amputated in the middle*, the assistant and the operator grasp it behind and before the part where it is to be cut off, without drawing the skin either backwards or forwards. The rest of the proceeding is as in the former case.

2478. In *removing the penis near the pubic bones*, SCHREGER has recommended the cut to be made with repeated strokes, to prevent the retraction of the stump, and render the application of the ligatures more easy. An assistant presses up the bulb from the *perinæum* forwards towards the pubic angle, and then, the operator having first drawn the *penis* and the skin forwards, divides the skin upon the *dorsum penis* and ties the dorsal arteries; after making the second cut, he proceeds in the same way with cavernous arteries of the *penis*, and after the third, with the cavernous

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(*a*) EARLE; in Med.-Chir. Trans., vol. xii. p. 289.

arteries of the *urethra*, and the bleeding having been thus stanched, the remainder of the *penis* must be cut through. The dressing is to be made as already directed. If the bleeding from the spongy bodies cannot be stopped by sprinkling with cold water, the wound must be sprinkled with some styptic powder, covered with lint, and this fixed as already directed.

Langenbeck (*a*) proposes to prevent the retraction of the *penis* in the following way: he cuts through the *dorsum penis* so deeply into the cavernous bodies, that he can see their white edge and the *septum;* a loop is then drawn through both, and the *penis* completely cut through. The ligature serves to keep the stump steady, and to draw it forwards.

To prevent the retraction and drawing together of the *urethra*, Barthelemy (*b*) advises introducing an elastic catheter, which is to be bent down by an assistant beneath the arch of the *pubes*, and then the *penis* and catheter to be cut through.

2479. Of the accidents which may occur after the operation, after-bleeding requires special attention. If it occur from a vessel which has not been tied during the operation, it must be taken up at once. If from the spongy bodies, it must be endeavoured to stanch it with cold water, styptic powders, and pressure, or when this is inefficient, and the length of the stump permits, pressure is to be made on the tube already introduced with a roller, or strips of sticking plaster; but if these means be fruitless, the actual cautery must be employed. Violent inflammation and spasmodic retention of urine must be treated according to the ordinary rules.

The tube in the *urethra* must not be removed till the scarring is complete, otherwise the opening of that canal is narrowed; and even then it is often necessary, as I have sometimes seen, to prevent the contraction by leaving a bougie in; on the other hand, there are cases in which without any bougie, no narrowing of the *urethra* ensues.

After the most successful operation, even in aged persons, whose procreative powers have ceased, there is often no means of preventing lowness of spirits and melancholy.

2480. *In removing the penis by tying*, a silver male catheter must be passed through the *urethra* into the bladder, a waxed silken thread applied beyond the diseased, and upon the healthy part of the *penis*, and introduced into a loop-tier or some particular instrument for tying a ligature. This instrument must be screwed so tight that the part before the ligature shall be deprived of all feeling; the instrument is to be fastened with sticking plaster, and the cancerous part covered with lint and compresses. On the second or third day, usually the largest portion of the dead *penis* may be removed with scissors or bistoury, without bleeding or pain; and on the fourth or fifth day the ligature separates. The catheter may now be removed; a small silver or gold tube introduced into the *urethra*, and the suppurating part dressed simply till it scar (*c*).

2481. Amputation of the *penis* with the ligature is preferred by most practitioners to that by the knife. The inconveniences, however, which usually arise from the former, as great and continued pain, by which fever, convulsions and the like may be produced, and the noxious effect of the sloughing mass upon the whole system, by which Graefe's mode of

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(*a*) Neue Bibliothek für die Chirurgie und Ophthalmologie, vol. i. p. 737.

(*b*) Archives Générales de Médecine, vol. xxiv. p. 133. 1830.

(*c*) Biener, above cited.—Speier, E., Dissert. de Castratione. Berol, 1820.—Michaelis, Ueber die Exstirpation des Penis durch Ligatur; in von Graefe und von Walther's Journal, vol. iv. p. 331.—Bloemer, Ueber die von Graefe angegebenen und verbesserten Unterbindungstöcken; in same, vol. v. p. 356.—Michaelis, Neue Erfahrungen über Graefe's Amputationsweise des Penis; in same, vol. xiii. p. 210.

operation is beset, must not be overlooked. The most important advantage of tying is security from bleeding, which may be very severe at or after the operation, although proper caution will prevent this, as my experience has proved.

[I have never seen any trouble or difficulty from the bleeding at or after the removal of the *penis* with the knife, and should think the scarring would be more quick, and much less painful by this method than by the ligature, of which, however, I have not had any experience.—J. F. S.]

2482. As in many cases, although the carcinomatous swelling increases the *penis* to double its size, it does not attack its whole substance, but is confined to the cavernous bodies, so that according to LISFRANC, the degenerate mass may be removed by a cut made from before backwards beyond the diseased part, from the back of the *penis*, by short strokes of the knife, carefully cleansing the wound with a sponge till the whole fibrous covering of the cavernous bodies has been laid bare. If this be found healthy, the diseased mass must be carefully removed, and only when the degeneration has penetrated more deeply should the *penis* be amputated. This opinion is supported by some successful cases (*a*).

F.—OF CANCER OF THE TESTICLE.

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COOPER, Sir ASTLEY, Bart., Observations on the Structure and Diseases of the Testis. London, 1830. 4to.

(*a*) MARGOT, Sur le diagnostic des divers degrés de profondeur des Cancers de la Verge; et Observations sur deux Cas, dans lesquels on a preservé les Malades à l'Amputation du Penis; in Revue Médicale. 1826, vol. iv. p. 337

Curling, T. B., A Practical Treatise on the Diseases of the Testis and of the Spermatic Cord and Scrotum. London, 1843. 8vo.

2483. The various chronic swellings to which the testicle is subject, and by which its *parenchyma* is converted into a foreign substance, are usually comprehended under the general designation *Sarcocele* (*Sarcocele, Hernia carnosa*, Lat.; *Fleischbruch*, Germ.; *Sarcocèle*, Fr.) Under this term, are ranged together induration, scrofulous and syphilitic swelling of the testicle, scirrhous, sarcomatous degeneration, varicose swelling, and medullary *fungus*. Some writers confine Sarcocele to cancerous degeneration of the testicle; others name as Sarcocele a variety of *elephantiasis*, in which the skin of the *scrotum* becomes a fleshy substance, attached as it were to a neck, and with which generally the testicle is unconnected: it is most proper, however, to restrict the term Sarcocele, simply to the sarcomatous degeneration of the testicle.

2484. *Scirrhus of the Testicles* is generally preceded by inflammation or other external injury, or it occurs of itself without any apparent cause. The testicle swells, becomes hard; may continue a long while in this condition without causing any inconvenience; at last, after some accidental irritation, or of its own accord, the swelling becomes greater, harder, irregular, and knobby, and lancinating pain runs along the course of the spermatic cord. The scirrhosity spreads over the cord, which thickens and becomes firm and knotty; the neighbouring glands swell; the skin of the *scrotum* adheres to the swelling, at last bursts, and an ulcer with hard out-turned edges, and a discharge of stinking *ichor*, or with fungous growths, is produced, and the pain becomes very severe in the region of the loins and spermatic cord. Whilst this is going on in the testicle, the general health becomes very much affected, and the previously-mentioned symptoms set in. The interior of the hardened testicle consists of a hard tallow-like substance, of a grayish or brownish colour, oftentimes containing distinct cells filled with a sanious fluid.

2485. In *Sarcomatous degeneration of the Testicle*, its substance is changed in the same way as already described of Sarcoma in general, (*par.* 2281.) There is an excessive collection of coagulable lymph in the *parenchyma* of the testicle; the spermatic arteries and the branches they give to the coverings of the testicle are sometimes pretty numerous, and considerably enlarged. In *sarcoma* the testicle often retains its shape for a long while, is oval and flattened on both sides, its larger end is directed upwards and forwards, its smaller one downwards and backwards. Its weight, in proportion to the size of the swelling, is always considerable. This disease generally causes no other inconvenience than that of dragging on the spermatic cord, if unsupported by a bag-truss. It is free from pain, the skin covering it has its natural condition, which is only first changed on very great enlargement of the swelling. The spermatic cord may indeed swell, but does not become knotty and knobby. If such sarcomatous swelling be left alone, or if it be irritated by treatment, it may run into cancerous degeneration.

2486. During the progress of *scirrhus* as well as of *sarcoma* of the testicle, a collection of water is not unfrequently formed in the *scrotum*, (*Hydrosarcocele*,) which is to be considered as a consequence of the degeneration of the organ. There is then felt a firm, regular swelling, and frequently distinct fluctuation. Sometimes the surface of the testicle unites with the vaginal tunic into one indistinguishable mass.

2487. The distinction of scirrhous and sarcomatous degeneration of the testicle from other swellings which occur in its *parenchyma* or its coverings, is in most cases exceedingly difficult, and requires careful examination of the swelling and of the way in which it arose. Swellings of this kind are, *first*, thickening of the cellular tissue of the *scrotum; second*, hydrocele; *third*, hydatid or cystic tumour of the testicle; *fourth*, hardening of the *tunica albuginea* of the testicle; *fifth*, *fungus* of the *tunica albuginea* or of the testicle; *sixth*, induration of the testicle consequent on acute inflammation; *seventh*, scrofulous and syphilitic swelling of the testicle; *eighth*, medullary *fungus*.

2488. The *thickening of the cellular tissue of the scrotum*, which is infiltrated by a quantity of fatty, watery, or bloody fluid, forms a swelling with a broad base, and at the same time attached to a stem, of which the size is sometimes so considerable that the *penis* is completely covered; the opening of the prepuce has the appearance of a navel at the end of the swelling, and the patient is prevented walking. Its weight is sometimes as much as one hundred pounds. Externally the tumour presents various degrees of roughness, separated by the hollows which correspond to the *cryptæ mucosæ* or the roots of the hairs. Upon a large portion of the tumour when it has long existed are formed yellowish crusts or scales, which as they drop off leave a corresponding number of ulcers bare, and secreting an ichorous fluid. The swelling is painless, bears even violent pressure in various directions, is at some parts hard, at others soft, and is only troublesome to the patient by its weight. The testicle and spermatic cord are generally natural, only the spermatic vessels are lengthened. This disease is most common in hot countries, although it has also been noticed in France, England, and Germany. According to LARREY, who frequently saw it in Egypt, persons who sit at their work are peculiarly subject to it. Syphilis and other vicious states of the juices may be reckoned among its internal causes; the patient is frequently at the same time subject to *elephantiasis*, of which this disease seems only a modification.

When the disease has not attained a very great height, its dispersion may be attempted by antimonial, mercurial, and diaphoretic remedies, by the alterative use of mineral acids in small quantities with mucilaginous drinks. Externally by lotions of dilute sulphuric acid, solution of bichloride of mercury, of sulphate of iron, and of hydrochlorate of ammonia.

If notwithstanding this treatment the tumour become larger, the operation is the only remedy. For this purpose two cuts are made in front of the aperture of the prepuce which separate below from each other, and run down on both sides, below the testicles. In these directions all between the cavernous bodies of the *penis* and the testicles, in which care must be taken to avoid the testicles, spermatic cords, and cavernous bodies, and the whole mass below the line of the cut removed. The remainder of the sarcomatous mass must be shelled out. The bleeding vessels must be tied at once, and the edges of the wound brought together with sutures, sticking plaster, and a proper bandage (*a*).

[This disease does not generally exceed such size as might render it liable to be

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(*a*) Ephemerides Nat. Curiosorum, 1692.—MORGAGNI, Epistolæ Anatomicæ, xliii. Art. 42.—LARREY, Mémoires de la Chirurgie Militaire, vol. ii. p. 110.—RICHERAND, Nosographie Chirurgicale, vol. iv. p. 432. Fifth Edition.—TITLEY; in Med.-Chir. Trans., vol. vi. p. 71.—DELPECH; in VON GRAEFE und VON WALTHER's Journal für Chirurgie und Augenheilkunde, vol. ii. p. 647 —VON FRORIEP's Kupfertafeln, pl. cxxvi.

mistaken for disease of the testicle itself; but with careful examination it is scarcely possible to mistake the one for the other.

In some instances, however, the *scrotum* seems to participate rather than give origin to similar growths of cellular tissue, with adhesive deposit in its cells, which has been already mentioned, (p. 711,) and which has, perhaps, been not very correctly spoken of as *elephantiasis* of the *scrotum*. These sometimes acquire very enormous size, and have occasionally been removed. Some such have been already noticed, but as their removal is attended with considerable danger, it would seem, from the sudden loss of venous blood, it will not be improper to advert to the subject again.

In LISTON's case (*a*), already cited, of the tumour which weighed nearly fifty pounds, and was removed from a man of twenty-two years of age, the disease "had commenced when he was only ten years of age, and had gone on increasing gradually from that time. It measured forty-two inches in circumference, and forty from the verge of the *anus* to the *pubes*, betwixt which parts it was attached. The greater bulk of the tumour lay behind, and extended lower than the patient's knees. * * * The incisions were made from behind. I had intended to preserve as much of the genitals as I might find it possible to do, on examining their attachments and connexions with the diseased mass. But immediately on the bistoury being carried round the base of the tumour, the hæmorrhage was so profuse that any attempt of the kind had to be abandoned, for the more essential and immediate object of saving the patient's life. * * * The tumour was therefore detached as rapidly as possible,—in not very many seconds,—and the mouths of the large and numerous vessels running into it covered as they were divided, by our fingers. The flow of blood was compared by those present to the discharge of water from a shower-bath, so instantaneous and abundant was it. Before half the vessels could be tied, the patient had sunk off the table without pulse, and with relaxed muscles, voluntary and involuntary." From this condition he was recovered, and then, in his Practical Surgery LISTON states, the remaining vessels were from twelve to sixteen, but whether they were arteries or veins is not mentioned. In three weeks he was able to walk about, and soon after the complete cicatrization of the wound took place. The tumour is in the Museum of the Royal College of Surgeons of England.

The following is KEY's case (*b*), which from its enormous size excited great interest.

Hoo Loo, aged thirty-two years, ten years previous to his admission (March 17, 1831) into Guy's Hospital, "first perceived the extremity of the prepuce to swell and become hard, and it continued to increase for about four years. At the end of this period the *scrotum* began gradually to enlarge up to the present time, when it had acquired the enormous magnitude of four feet in circumference, its increase having been for the last two years remarkably rapid. * * * The appearances of the tumour at the time of operation (April 9) were as follows:—Its body was of a flattened spheroidal form, four feet in circumference, and attached by an equilateral triangular neck of half that size, which, opposite the pubes, measured exactly eight inches across, and extended about two inches and a half beyond each external abdominal ring. The other sides corresponded to the lateral boundaries of the *perinæum*, and met at an acute angle immediately before the *anus*. Its length was such, that when the man was erect, its lowest point was about opposite to the tubercles of the *tibiæ*. On its neck and lateral portions, the integuments were healthy in appearance, whilst on its anterior part they were considerably thickened, indurated, and had a tuberculated honey-comb appearance, with a few small ulcerations, from which a slight serous transudation took place. Near the centre of the body of the tumour, an irregular projection, supposed to be elongation of the prepuce, concealed the orifice from which the urine escaped. The integument covering this projection seemed more diseased than that of any other part of the tumour, being closely studded with numerous small elevations of the *cutis*, and from this projection, an elevated ridge extended backwards through the medium line of the tumour, and evidently was the enlarged *raphe* of the *scrotum*. The plan of the operation was this:—To make three flaps; one from the upper part of the neck of the tumour, to envelope the *penis*, and a semilunar one on each side to form a covering for the testicles and *perinæum*." In making the first lateral "incision, several large veins were divided, which bled freely, but were immediately secured by ligatures. This flap was then dissected back, during which several large vessels were tied. At the lower part of the flap, one particularly large vein was secured. A flap of the same kind was made on the opposite side, during which, but comparatively few vessels were divided. The next step of the operation consisted in laying bare the cords; and in cutting down upon the right one, a

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(*a*) Edinburgh Medical and Surgical Journal, vol. xix. p. 566. 1823. This account is the most circumstantial, and is that here quoted.

(*b*) Removal of an immense Tumour, occupying the region of the *Pubes* and *Perinæum*; in London Medical Gazette, vol. viii. p. 93. 1831.

small artery, the first that was seen, was tied. At this time, the patient's powers appeared so depressed, that it was determined "no further attempt should be made to save the *penis* and *testes*." Mr. KEY, therefore, "passed a temporary ligature round each spermatic cord, and then divided them. A band was then passed round the *penis* in the same manner, which was then cut through about an inch and a half from its root. The tumour was now dissected from the *perinæum*, which occupied but a very short time; in this separation, two small arteries were divided, and instantly secured. The ligatures were then removed from the cords and *penis*, and each spermatic artery tied separately. During the greater part of the operation, and especially towards its latter end, the man's powers were greatly depressed, and two fits of *syncope* occurred, yet after it was finished, his pulse, though weak, could be felt at the wrist. However, in a few minutes another fit of *syncope* came on, from this he never rallied." Every means to restore him, including transfusion, were in vain. The operation lasted an hour and three-quarters; this was principally occasioned by the necessity of tying so many vessels, the whole of them veins, with the exception of three very small arteries, besides the two spermatics; and by being delayed during the two fits of *syncope*. Although upwards of thirty ligatures were applied, not more than twenty ounces of blood were lost, and of this scarcely one ounce arterial." * * * The weight of the tumour, when removed, was fifty-six pounds, eight ounces. Mr. KEY was decidedly of opinion, and expressed himself to that effect, that the patient's death was occasioned by the loss of blood, which, though by no means excessive, from the precautionary measures adopted, yet made an impression on the feeble system of an Asiatic, which his powers were unable to overcome. * * * The tumour was found to consist of the cells of the cellular membrane enlarged, and containing a yellowish dense serum. Some parts of the tumour contained indurated masses, resembling cartilage. The tumour, when entire, undulated, and was thought by some to contain a large quantity of fluid in one cyst; but the fluid was contained, as is usual in *elephantiasis*, in cells of various dimensions, bu tnone exceeding a marble in size."

Warned by the fatal result of this case, and also from the violence of the bleeding in LISTON's patient, O'FERRALL (*a*), to guard against such untoward circumstances, in operating on "an enormous tumour of the *scrotum* of a man forty-four years of age, which descended nearly to his knees, disabled him by its great weight, and had nearly exhausted his strength by profuse bleeding from large veins on its surface," adopted the plan "of placing the patient on his back, and having the tumour poised for a sufficient length of time to empty its vessels before the incisions were commenced," and the result justified his expectations. The disease had commenced ten years before, in "a hard swelling on the cord, the size of a marble, about an inch above the left testicle," which "continued progressively to enlarge. * * * The last hæmorrhage from the veins of this tumour amounted, he was convinced, to two quarts of blood. The exhaustion was very great, and rendered him for some time unable to pursue his avocations." When admitted into St. Vincent's Hospital, "the figure of the tumour was irregular; it arose by a pedicle from the *pubes* and *perinæum*, and expanded in its descent into a huge mass, the widest portion of which was about four inches above its lowest part. The integuments which covered the pedicle were evidently borrowed by traction from the *abdomen* and groin, and presented four distinct and prominent folds; the skin covering the tumour was smooth, it was marked by numerous large venous trunks, which traversed its surface, and lay in furrows easily traceable by the finger. A small ulcer in the integuments over one of these veins marked the point from which the hæmorrhages had taken place. The left lateral aspect of the tumour, near its neck, exhibited several trunks of veins, larger than swan's quills, running parallel to each other, and, when the patient was in the erect position, projecting in strong relief. When poised upon the hands it gave the impression of considerable specific weight; its consistence was unequal; its hardest portion was an irregular mass of the size of an orange, of cartilaginous density, and situated about an inch below the left external abdominal ring. The greater portion of the tumour was solid, though not gristly to the touch. At two or three points of the remainder there was a degree of elasticity closely resembling fluctuation. * * * Of the *penis*, the *glans* was the only portion visible, it projected from the integuments at a point about three inches below the *pubes*. The remainder of this organ was buried in the morbid growth. * * * From the *pubes* to the *fundus* of the tumour measured twenty-eight inches; the circumference about its

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(*a*) Malignant Tumour of the Scrotum; in Dublin Quarterly Journal of Medical Science, vol. i, p 521. 1846. New Series.

middle was twenty-two inches and a half. The weight of this enormous mass was the principal source of inconvenience." The operation was performed on the 29*th November*, 1844. After making a puncture into the elastic part of the tumour with a trocar, through the canula of which nothing but a little blood came out, and the patient being placed in the position for lithotomy, "with a large broad-backed bistoury, O'FERRALL made in the *perinæum* two straight incisions meeting at an angle, salient towards the *anus*. Keeping close to the tumour, the incisions were carried rapidly round its under and lateral surfaces, exposing on the right side the covering of the testicle, and on the left a bunch of cylindrical convolutions as large as the finger. * * * Their uniform blue colour, solid feel, and entire absence of gaseous contents, at once convinced us that it was an enormous *varix* of the cord of the left side. The tumour being now detached as far as possible laterally and underneath, was allowed to descend to a nearly horizontal position, in order to complete the operation in front. Two straight incisions carried downwards from the groins, were made to meet at an angle, so as to include a portion of integument capable of covering the *urethra*, and fitting into the incisions previously made. The tumour was now rapidly detached, and the cord being held, was cut across. A few strokes of the bistoury completed the separation of this enormous mass from the body of the patient. The vessels of the cord and a few small subcutaneous branches were now secured, and the patient was put to bed. The loss of blood was very inconsiderable, not exceeding perhaps four ounces." The operation was completed in eight minutes. After a few hours the flaps of integument were brought together with sutures. About nine days after the operation the patient was attacked with erysipelas, which spread down the thighs, upwards over the body to the shoulders, then over the scalp and face, and after about seventeeen days subsided completely. Shortly after he had a fit of acute rheumatism, from which, however, as well as the general consequences of the operation, he rapidly recovered. On *examination of the tumour*, "a loose capsule of cellular tissue enveloped the morbid growth. A section carried through its middle showed that the whole was perfectly solid, and without the slightest appearance of a cyst. The cut surfaces reminded us strongly of the section of the larger varieties of fibrous tumour of the *uterus;* whitish, with the slightest possible tinge of yellow. The substance appeared to consist of a number of lobules, separated by lines of condensed cellular tissue, and marked here and there by minute granules of calcareous deposit. The greater number of bloody points presented by the section, however, distinguished its appearance from that of the fibrous tumour of the *uterus*. Some of the lobules almost resembled in density a section of the intervertebral substance Others more elastic appeared to have undergone a change approaching the character of encephaloid disease. This impression was confirmed by Dr. HOUSTON, who found that it presented under the microscope the mixture of fibres and cells, characteristic of malignant structure. It was in these situations that the deceptive feeling of a cyst had previously existed. The left testicle was, after a careful search, found to occupy the position mentioned by the patient. It was atrophied, but otherwise unchanged, and lay enclosed in its moist and polished *tunica vaginalis*. The cord above it was lost in the tumour."

In the very remarkable case related by BENNETT (*a*), the disease had commenced "nine or ten years before, in the form of a swelling on each side of the groin, which gradually increased in size, descended, and, he says, united and formed one mass, entirely covering the *penis*." The tumour has been gradually increasing from that time, and has now reached to the insteps. The weight of the tumour, so far as could be ascertained, was about ninety-six pounds avoirdupoise, and the size, by careful measurement, was found to be as follows:—The length from the crest of the *pubes* to the base (bottom) of the tumour, two feet five inches; circumference of the upper part, just below the *pubes*, twenty-one inches; of the centre, four feet; of the largest part, just below the *urethra*, four feet eight inches. The tumour was at some parts smooth, at others had a wrinkled appearance, excepting at the lower part of its right side, which was tuberculated and livid; the general colour, however, was a dirty yellow. It was very callous to the touch, except at the upper part about the *pubes*, and a few inches below. The tumour was composed, as appeared on cutting into it, of an indurated substance, about the consistence of cartilage, and of a similar white colour. No operation was performed.

In all these cases it will have been noticed, that the *scrotum* was only secondarily, not primarily affected.]

(*a*) Case of enormous Tumour of the Scrotum in a Native of the Island of Tahiti, (Otaheite,) Southern Pacific Ocean; in London Medical Gazette, vol. viii. p. 101. 1831.

2489. *A simple hydrocele* cannot well be confounded with sarcocele. Only at first, when the collection of water is not great, it is sometimes accompanied with severe pain on account of the distension of the vaginal tunic, which, in connexion with the great hardness of the swelling, may lead to a mistake. But when that tunic is considerably thickened, and even cartilaginous, the feel is easily confused, and the practitioner may mistake the swelling for hydrosarcocele. In this latter complaint, however, the hind part of the swelling is generally harder and knobby ; the spermatic cord is also usually knotty, and there is lancinating pain. In doubtful cases, puncture always resolves the difficulty.

2490. *Cystic swelling of the testicle* begins with a thickening of the *epididymis;* it is, however, generally only first noticed when the disease has spread over the testicle, and has made some progress. In addition to the swelling, the testicle retains its natural form, round in front, flattened on the sides, and not so bean-shaped as in hydrocele. Between the testicle and the *epididymis*, usually, though not always, the natural line of distinction still remains. The swelling is not tender if not subjected to violent pressure, but when smartly pressed, the patient feels as if the testicle were squeezed. The tumour yields to pressure, though it does not show true fluctuation ; if it be compressed at one part with the finger, it is not raised at another part, but merely appears to yield all over. Pain and uneasiness in the loins are produced by the weight and size of the testicle, although the disease still remains local.

On examining a testicle of this kind after removal, the vaginal tunic is found thickened, in part adherent, and the *tunica albuginea* firmer ; the testicle appears to consist partly of firm tissue and partly of cysts, the size of which varies from that of the head of a large pin to that of a musket-ball. The smaller cysts, of which the walls are very vascular, contain a serous, clear, or yellowish fluid, and the larger, of which the walls are thick, have a mucous substance. ASTLEY COOPER believes the cysts to be obstructed efferent tubes, into which a diseased secretion is poured out. Nothing precise is known of the occasional causes, the patient often ascribes the disease to cold, or to a blow.

This tumour may be most easily confounded with hydrocele ; the cystic tumour, however, is more compressible than fluctuating, heavier, the form of the testicle is retained, but rather more bean-shaped, is not transparent when a light is held behind it, and when violently pressed is painful as when the testicle is squeezed. In hydrocele, the testicle can be felt behind, although indistinctly.

The removal of the testicle is the only remedy, and the recurrence of the disease not to be dreaded if the cystic disease be not complicated with medullary *fungus*, as may be seen after the removal of this organ, and always renders the *prognosis* unfavourable. True hydatids may also exist in the testicle (*a*).

2491. The *tunica albuginea of the testicle is sometimes thickened*, irregular, cartilaginous, and sometimes bony, the testicle, however, still retaining its natural condition. The swelling is in these cases painless, makes only irregular slow progress, and in general there is a collection of water in the vaginal tunic. The disease has no relation to cancer of the testicle, and does not require extirpation. *Scirrhus* may, however, be developed in the *tunica albuginea* which has adhered to the vaginal tunic,

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(*a*) ASTLEY COOPER, above cited, p. 63.

in which case, the scirrhosity in general attacks the *epididymis*, but the testicle, although surrounded with some serous fluid, is either little or not at all altered. Several observations appear to prove that after extirpation of the testicle, its recurrence is to be but little dreaded (*a*).

2492. *Fungus of the testicle, or of the tunica albuginea*, is a peculiar disease, easily mistaken for *sarcoma.* In general, after external violence, or after a clap, a swelling of the testicle begins, which is often very considerable and hard. A small abscess forms, with severe pain, bursts, and out of the aperture a *fungus* gradually grows. If, in this complaint, after the inflammatory affection of the testicle has diminished, the testicle itself be not very greatly enlarged or hardened, it is best to remove the *fungus* and the diseased part of the testicle, without taking away the latter completely. This is best done with the knife, and in some cases the ligature or caustic may be employed. When the whole substance of the testicle is attacked with this *fungus*, it must be completely removed. The mere swelling and induration of the testicle, often ceases gradually after the extirpation of the *fungus*, and with proper treatment (*b*).

2493. *Induration of the testicle*, as a consequence of previous acute inflammation, presents a hard, usually irregular, though not rarely, knobby swelling, which is more or less painful on examination, but gives the patient no lancinating pain.

Repeated application of leeches, softening poultices, rubbing in mercurial or iodine ointment, and continued rest, usually effect its dispersion.

Scrofulous swellings of the testicle are less hard and painful than *scirrhus*: the testicle is thereby converted into a yellowish-white coagulated substance, like that found in scrofulous glandular swellings; but the spermatic cord is, for the most part, in its natural state. The swelling, however, frequently runs into ulceration, forms a painful readily bleeding *fungus;* the spermatic cord swells, and not unfrequently there is scrofulous degeneration.

In most cases these swellings are resolved by proper general treatment, and by the local application of resolvents.

Syphilitic swellings of the testicle and spermatic cord, in consequence of an inveterate pox, arise slowly, without any occasional cause, and commonly are developed in the *epididymis.*

A regular mercurial treatment most commonly effects their dispersion.

2494. *Medullary fungus of the testicle* is distinguished from sarcocele, by the more speedy growth of the swelling to a large size, by the absence of all hardness and irregularity, by the very indistinct pain, by the delusive feel of fluctuation, by the quick affection of the spermatic cord, and the spreading of the disease into the belly (*par.* 2295.)

2495. Most of the above-mentioned diseased states are distinguished from cancer of the testicle; they may, however, even if left alone or treated improperly, run into cancerous degeneration. It is, therefore, necessary when suitable treatment has been employed without effect for some time, to extirpate the testicle, because thereby alone is the passage into cancer prevented. For *scirrhus* of the testicle there is no other remedy than extirpation. In sarcomatous degeneration, by repeated local bleeding, by dispersing applications, and by the internal use of such reme-

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(*a*) Dictionnaire des Sciences Médicales, vol. i p. 13–15.

(*b*) LAWRENCE; in Edinburgh Med. and Surg. Journal, vol. iv. p. 257.—Dictionnaire des Sciences Médicales, vol. i. p. 16.

dies as promote absorption, the unnatural vegetative process may be kept down, or by tying the spermatic artery, the tumour may be diminished, or its growth prevented.

2496. *Extirpation of the testicle* (*Castratio*, Lat.; *Entmannung*, Germ.; *Emasculation*, when both testicles are removed) is for the patient a very painful and, in cancerous degeneration, as to its consequences, a very doubtful operation, as recurrence of the disease is very common. The expectation of a favourable result is greatest when the disease has been the consequence of external violence, is not connected with any general affection, and all the degeneration has been completely removed. It must be held to be contraindicated when there is any existing general disease, on which the disease of the testicle depends; when the neighbouring glands are swollen, and there is also disease of the spermatic cord, when the hardness extends so far up, that excision in a healthy part is not possible. If in such case there be also dragging pain extending up into the loins; if the swelling of the spermatic cord be hard, knotty, and the seat of lancinating pain. From this scirrhous degeneration of the spermatic cord, which in rare cases may precede the swelling of the testicle, a simple sympathetic swelling of the cord may be distinguished by its regularity, by not being knobby, and by diminishing towards the abdominal ring, and by the pain lessening when the testicle is supported by a bag-truss. A swelling of the spermatic cord may also depend on serous infiltration into its vaginal sheath. When with sarcocele swellings in the belly are connected (1), which on closer examination can often be distinctly felt, as well as with decided appearance of cancerous dyscrasy, the operation can only hasten death (*a*).

(1) The swellings which often form enormous masses in the belly, occur, indeed, generally in medullary *fungus* of the testicle; I have, however, seen them also in true cancer of that organ.

2497. For the purpose of rendering the removal of the testicle in sarcocele superfluous, WALTHER (*b*) has proposed tying the spermatic artery, which has been performed successfully by MAUNOIR (*c*). This operation can, however, only apply to those diseases of the testicle, in which a very copious deposit of plastic lymph into the cellular tissue of the testicle has caused unnatural development of vessels and sarcomatous degeneration, but no passage into cancerous degeneration.

In relation to this practice stands cutting through the spermatic cord with interfering with the testicle, which soon wastes (*d*).

2498. Tying the spermatic artery in sarcomatous swelling of the testicle is unaccompanied with any difficulty. A cut half an inch long must be made at the abdominal ring in the direction of the cord, which being laid bare, the pulsation of the very much enlarged artery may be felt. The vessel is to be isolated as high up as possible, by slightly cutting the cellular tissue surrounding the spermatic cord, and passing a single thread with DESCHAMPS' needle around it without including the *vas deferens*, nerves, or veins. The wound is to be brought together with sticking plaster. (*par.* 1538.)

(*a*) RUST, Zwei Beobachtungen über eine eigene Erhärtung des Hodens, als Folge einer Varicosität der Lymphgefässe, besonders der Cysterna chyli und des Ductus Thoracicus; in HORN's Archiv. 1815.—GIREL, Ueber den Fungus, die Struma testiculi; in Neue Chiron, vol. i. p. 273.

(*b*) Neue Heilart des Kropfes, u. s. w., p. 40. Sulzbach, 1817.

(*c*) Nouvelle Méthode de traiter le Sarcocèle sans avoir recours à l'Extirpation du Testicule. Genève, 1820. 8vo.

(*d*) WEINHOLD; in HUFELAND's Journal, vol. viii. part iv. 1842.

2499. The *removal of the testicle* is performed in the following way. The *scrotum* and neighbourhood of the abdominal ring having been cleared of hair, the patient should be placed horizontally on a table. The operator standing on his right side, nips up the skin in an oblique fold over the spermatic cord, gives one end of it to an assistant, and himself holds the other with the thumb and finger of the left hand. This fold is now cut into in the course of the cord, and extended upon a director up towards the abdominal ring and down to the bottom of the *scrotum*. The cellular tissue surrounding the spermatic cord is now to be separated by some cuts lengthways on the sides, and the cord lifted up, the cellular tissue beneath it being thus made tense, is cut through with the knife held flat, and as the knife is brought back, the operator passes the forefinger of his left hand into this opening, thereby stretches the remaining cellular tissue, and with his finger separates the cord up to the abdominal ring. The testicle being lifted up to lessen the stress upon the spermatic cord, an assistant grasps the cord above where it is to be cut through, and the operator holds it below, passes the knife beneath and divides it at a stroke. The arteries are now to be taken up with forceps or with a hook, and having been cleared, are to be tied. The testicle is to be shelled out of the *scrotum*, by which wounding of the *urethra* and the *septum scroti* are avoided. All the bleeding vessels are to be tied immediately.

When the skin of the *scrotum* is diseased, or firmly adherent to the tumour, it must be included either between two semilunar cuts, or after the cord has been divided, and the arteries tied, the testicle, and the skin covering it, must be removed with the knife, by which all injury to the *septum* is avoided. Any other practice for stanching the bleeding, than tying the vessels, is improper.

If the cord escape from the assistant, and retract into the inguinal canal, it must be attempted to seize it with the forceps and pull it out, or even the external wall of the canal must be cut into (1).

Aumont (*a*) cuts through the skin at the hinder part of the *scrotum*, which is to be raised and turned to the opposite side, from the bottom of the swelling to the abdominal ring. The testicle, which is laid bare by this wound, is then to be dissected up, and the cord bared to the abdominal ring; the testicle is then held by an assistant, and the cord, with forceps, by the operator, who cuts through it, and ties the arteries. The advantage of this is, that a smaller cut is made upon the least feeling part of the *scrotum*, and that the cord is more easily laid bare to the abdominal ring; hence its division and the tying of the vessels is more easy, there is less danger of after-bleeding, the escape of the secretion of the wound is more free, and its union better.

[(1) The escape of the cord immediately on its division is a very tiresome, and, to a young operator, very perplexing accident; to prevent its occurrence, Astley Cooper used to advise passing a thread through the cord, above the place at which the division was to be made, which gave full power over the upper end of the cord after its division, and the thread was removed after the spermatic vessels were tied. I prefer passing a strong tenaculum through the cord, which answers the purpose quite as well, and is more quickly done.—J. F. S.]

2500. If the spermatic cord be degenerated so far towards the abdominal ring that it cannot be held fast by the assistant, a ligature should be passed round, after isolating it, which should be bound to a piece of wood, and there held till the artery have been cleared and tied. To this case alone should the *complete tying* of the whole cord, by many considered as the proper mode of proceeding, be confined. The tie should then be made as tight as possible, which alone prevents the severe symptoms caused by tying nerves. If the degeneration extend so high up on the spermatic cord that it cannot be cut through in a healthy part, the in-

(*a*) Bulletin de la Société d'Emulation de Paris. 1822. April.

guinal canal must be opened, and the healthy part of the cord there cut through (*a*).

[Much stress was formerly laid upon not tying the whole cord before dividing it, on account of the severity of the pain; I cannot say, however, that I ever noticed it so violent as stated, or, indeed, worth noticing, in the many times I saw it tied by some of the older Surgeons, in the early part of my studentship. But tying the cord is objectionable, for a much better reason, which is the length of time the ligature requires to ulcerate through. The younger Cline managed the matter differently; he used to pass a strong thread around the cord, brought both ends through a piece of pewter catheter, tied them upon a stick at the top end, and then twisted stick and string, till like a stick-tourniquet, which it really was, it had compressed the vessels so completely as to prevent bleeding, when the cord was cut through. The thread was left on till the fourth or fifth day, then untwisted, and one end having been cut through, the thread was removed, if there were no bleeding. This practice I have often seen him pursue with great success.—J. F. S.]

2501. When the removal of the testicle is completed, the wound is to be cleansed, the extremity of the cord laid lengthways in it, and the ligatures fastened with strips of plaster. The wound is brought together with three or four stitches, and with strips of plaster, upon which are placed some soft lint, and compresses, and the whole fastened with a T bandage. The patient must be kept for the first twelve days pretty much in the horizontal posture.

The after-treatment depends on the degree of the inflammatory and nervous symptoms which set in, and is conducted according to the usual rules.

2502. A not unfrequent inconvenience after the operation is bleeding, which, if not quickly attended to, may produce very considerable infiltration and distension of the loose cellular tissue of the *scrotum*. If, after removing the dressing, some bleeding vessels be discovered, they must be tied. If the bleeding be from the whole surface, as if from a sponge, which, even at the time of the operation, may happen, attempts should be made to prevent it by cold water, and other styptic remedies, together with moderate pressure. If the bleeding will not so stop, the varicose part of the edge of the wound must be removed; in one case I found it necessary to stitch along the whole edge of the wound with a needle and thread.

2503. If the testicle have not descended into the *scrotum*, but remain lying in the inguinal canal, or at the abdominal ring, so much earlier do the symptoms of disease appear, partly from its confined position, and partially by the various results of violent exertion, and the like. There may occur inflammation, induration, scirrhous degeneration, and collection of water in the cavity of the vaginal tunic.

In all cases where the testicle lies at the groin, it is advisable to bring it down into the *scrotum*, by opening the *scrotum* and the abdominal ring. The spermatic cord offers no obstacle thereto, as it has its natural length, and lies coiled up behind the testicle. To keep the testicle in its place, a loop may be passed through the vaginal tunic and the bottom of the *scrotum*, and moderate pressure made at the abdominal ring (*b*). If any such testicle be hardened, it may be exposed in the same way, and the spermatic cord, which is easily distinguished, divided.

(*a*) For peculiar instruments to tie the spermatic cord, see Ravaton, Pratique Moderne de la Chirurgie, vol. ii. pl. ix. fig. 1, 2, pl. xii. fig. 1-4.—Rudtorffer, above cited.—Joachim, in Thaut, above cited.—Graefe, in Biener and Speier, above cited.

(*b*) Breyting, Dissert. de Testic. retropr. post hinc exstirpat. cum adn. circa monorch. et testicondos. Landsh., 1814.—Rosenmerkel, Ueber die Radicalkur des in der Weichelegenden Testikels. München, 1820.—Chelius; in Heidelberger klinisch. Annalen, vol. ii. part iii.

[The operation here recommended should not be performed as it is useless and cruel. The testicle, though seated in the groin, performs its functions equally well, and if there be any fear of its situation rendering it liable to injury, it may be protected with a cup truss.

It is of great importance that persons who are subject of this unusual position of the testicle, should be acquainted with the fact of it being matter of not the slightest consequence to their condition, as very serious mental alienation has occurred from their notion of being unlike other people, and incapable of performing an important function. In some instances, indeed, the horror of their presumed condition has led to self-destruction. Neither must it be omitted to mention that, although the testicle has been seated for many years in the groin, yet that occasionally, without any apparent cause, it will descend and take its natural place in the *scrotum*.—J. F. S.

There is not any reason why the testicle remaining in the groin should not be attacked with disease, as it is after its descent into the *scrotum;* but such cases, as far as I am aware, are exceedingly uncommon; the following three examples are therefore very interesting; the first two are histories attached to casts in the Museum of St. Bartholomew's Hospital, for which I have to thank my friend PAGET; and the last is now (November) in the Middlesex Hospital, under the care of my friend ARNOTT, who has kindly furnished me with his notes.

Case 1. The man was a labourer, aged forty-four years. His mother said, that at the time of his birth a small tumour was observed in his groin, which has remained there ever since. Seven years before his death it began to increase considerably in size, and six weeks previous to Mr. SARGANT seeing him, in November 1830, it had attained such bulk as to incapacitate him from following his usual employment. At that time it seemed attached to the anterior superior spine of the *ilium* and to the upper part of the *pubes*, and hung down over the thigh; and was considerably inflamed. Treatment was adopted calculated to remove this condition: and soon after he came to St. Bartholomew's Hospital; but in January 1831 he returned to Mr. SARGANT's care. The tumour had then greately increased in size, and was slightly inflamed, accompanied with considerable fever and general disorder. Mild antiphlogistic remedies were adopted, and after the application of a blister, were maintained for a week; the tumour pointed at its most depending part, and having been punctured, a pint and a half of green, offensively-smelling matter was discharged. He was allowed nutritious diet, with wine, &c., and was soon able to leave his bed and walk in the open air, about eight ounces of matter, however, being discharged daily. In the following *April*, his strength having regularly increased, he was able to walk four or five miles in the day, and the tumour continuing to discharge, was much decreased in size. On the 11*th* of the same month, hæmorrhage, to the amount of about a quart, took place, it was supposed from a branch of the epigastric artery. After this he seemed, for a time, to have recovered his previous improved condition; but in the beginning of *June* was attacked with fever, occasional shiverings, great and most distressing pain in the loins, and the tumour again rapidly and considerably enlarged. The discharge at this time was lessened; but on the 20*th* of the same month, a fresh opening was spontaneously made near the former one, and from this a copious discharge ensued, accompanied about every three days with a discharge of about eight ounces of blood. The bowels now became obstinately costive, and he had great irritability of stomach, with constant retching and vomiting. He continued in this state, but gradually becoming worse, and on the 27*th of July* died. On *examination*, the stomach, liver, and spleen were found healthy. The mesenteric glands were considerably enlarged and indurated, and on being cut into, discharged the brain-like substance observable in medullary *sarcoma*. The testicle could not be found; nor could the spermatic cord be traced beyond the tumour, though it was carefully sought for. What remained of the tumour was a mass of soft encephaloid substance.

Case 2. Was under the care of LAWRENCE of Brighton, and the cast was made on account of its similarity to the former. In this also the testicle had not descended into the *scrotum*, and it was presumed that it was an encephaloid tumour of that organ which had produced the enlargement.

Case 3. *Richard Long*, aged 43 years, was admitted into Middlesex Hospital,

Nov. 3, 1846. On account of a tumour in the right groin; it is large, prominent, and of an oval shape, with its long diameter nearly in the direction of POUPART's ligament, which, however, it covers somewhat obliquely; the greater part of the upper and outer end of the mass of the tumour being above the ligament, the greater part of the lower and inner end being below its level. Over the surface it measured nine inches in the long direction, and six and a half in the short. It extended from within two and a half inches of the anterior and superior spinous process of the *ilium*, to a little beyond the *pubes*, where it was in contact with the root of the *penis*. Its surface was uniform and smooth; it felt firm and resisting, and gave the idea of solidity, but at one part communicating an indistinct sensation of some fluid being present; it is nowhere diaphanous. No impulse is communicated on coughing, although from the motion on its surface during this action, it is evidently covered by at least the superficial *fascia* of the *abdomen*. It can be grasped, and is to a certain extent movable, but it cannot be fairly raised from its attachments behind. The *scrotum* and testicle on this side are wanting. The patient, a farm-labourer, of hale appearance, and father of seven children, states, that he never had a testicle in its proper place on the right side, but that up to four years ago, there was a small swelling, the size of a nut, in the groin, and he points to a situation above POUPART's ligament, corresponding to the internal abdominal ring, or upper part of the inguinal canal. That it was unattended by pain. Four years back, as he was one day engaged at his work, making trusses of hay, it came lower down; and he tried to get it up again, but without success. It was then, he states, the size of a walnut, and has continued gradually to enlarge ever since, but without pain or inconvenience, except from its increasing bulk.

" Viewing the case," says ARNOTT, " as one of disease of the undescended testicle, but unable to determine its precise nature, whether hydrocele or hæmatocele with a thickened *tunica vaginalis*, cystic sarcoma or malignant disease, I this day (*Nov.* 5) told the patient that it would be necessary to puncture the tumour, and then proceed according to its nature, so as even to remove it if necessary. His mind not having been prepared for this, and no application having hitherto been used, he wishes some trial of these to be made in the first instance; and as he has but just entered the house, he will be indulged."

Nov. 13.—The operation was performed to-day, and the case found to be one of medullary *sarcoma* of the testicle, which had never got out of the external ring, the diseased mass being covered with the tendon of the external oblique, which I had to slit up over the whole length of the swelling.]

G.—OF CANCER OF THE SCROTUM.

POTT, PERCIVAL, Chirurgical Works, vol. ii. p. 225. Edit. 1783.

SIMMONS, W., Observations on Lithotomy; to which are added, Observations on Chimney-sweeper's Cancer. Manchester, 1808. 8vo.

EARLE, HENRY, On Chimney-sweeper's Cancer; in Med.-Chir. Trans., vol. xii. p. 296.

TRAVERS, BENJAMIN, On same; in same, p. 344.

EARLE, HENRY; in London Medical and Surgical Journal, vol. i. p. 6. 1832.

COOPER, Sir ASTLEY, Bart., Observations on the Structure and Diseases of the Testis, p. 226.

2504. Under the name of *Chimney-sweeper's Cancer*, POTT has described a peculiar cancerous degeneration of the *scrotum*, to which the chimney-sweepers in England are subject (1). A warty excrescence sprouts upon the lower part of the *scrotum*, which may remain unchanged for months and years; it forms a superficial but painful ill-conditioned ulcer, with hard and outturned edges. Almost invariably young persons are attacked with this complaint, so that not unfrequently it is taken for a venereal affection, but antisyphilitic treatment of all kind, renders it more painful and makes it worse. In a short time the ulcer spreads over the skin of the *scrotum*, penetrates deeply, and attacks the testicles, which swell and become hard. Hence it spreads along the spermatic cord to the *viscera* of the belly; the glands in the groin swell, and the patient sinks under the severity of the pain from extensive ulceration (2).

[(1) " Other people," says POTT, " have cancers of the same parts, and so have others besides leadworkers the Poictou colic, and the consequent *paralysis*, but it is nevertheless a disease to which they are peculiarly liable; and so are chimney-sweepers to the cancer of the *scrotum* and testicles." (p. 227.)

According to Dr. PARIS (*a*) " it deserves notice that the smelters are occasionally affected with a cancerous disease in the *scrotum*, similar to that which infests chimney-sweepers, and it is singular that **Stahl** in describing the putrescent tendency in the bodies of those who die from this poison, mentions in particular the gangrenous appearance of these parts." (p. 97.)

Although the disease almost invariably is produced in the *scrotum*, yet in rare cases it is seen on other parts. **Earle** mentions "a remarkable instance of its occurrence at the wrist of a gardener, who was every spring employed to distribute soot for the destruction of slugs, which is related by his father in the last edition of **Pott**'s Works" (p. 297.) **Astley Cooper** saw chimney-sweeper's cancer twice, and **Keate** once upon the cheek.

(2) **Earle** states that when from infection by this disease, the testicle "becomes greatly indurated, ulceration, and sometimes sloughing, then take place, leaving a deep excavated ulcer, that penetrates into the body of the *testis*, which does not appear disposed to the formation of fungous growth similar to what occurs when the *scrotum* is the seat of the disease. The same observation applies when the complaint has extended itself to the inguinal glands; its progress in glandular structures appears to be more rapidly destructive, without the slightest effort at reparation. The disease in every instance that I have seen, except one, extended itself to the parts immediately contiguous. The inguinal glands are often enlarged, but they will generally subside on the removal of the diseased *scrotum*, clearly proving that the disease is not commonly communicated in the course of the absorbents. This is a very important feature in the complaint, and one which most materially influences the *prognosis* and treatment. I know but one exception to this rule, where a bubo formed, which suppurated, and the sore assumed the same character as the primary affection in the *scrotum*." (p. 298.) This statement of the subsidence of a swelled inguinal gland, is very remarkable, and if generally supported, would form a very important and hopeful feature in the disease; but I am afraid experience does not verify it.—J. F. S.

Travers (*b*) says:—"The disease resembles *lupus* of the cheek and eyelids in destroying the skin and cellular texture, leaving the testicles and ligamentous covering of the *crura penis*, as that does the sclerotic, bare and wasted, but otherwise uninjured. This sore has no tendency to slough or penetrate deeply by ulceration. The lymphatic glands are rarely, and seldom, specifically affected." (p. 345.)]

2505. The cause of the disease must be considered to be the ingriming of soot into the wrinkles of the *scrotum* (1). It rarely occurs before thirteen years of age (2), and appears at first to be simply a local disease, although there may be a general disposition thereto (*c*.)

The only remedy to prevent the progress of the disease is cutting out the ulcerated part of the *scrotum*, or its destruction with arsenical ointment. If the operation be put off till the testicle be affected, extirpation has in general an uncertain result; and in many cases although the wound have completely healed, the disease may re-appear some months after (3). When it has once spread so far that the removal of the testicle is no longer possible, palliative treatment according to the general rules, alone remains.

[(1) It may be this disease depends on some chemical peculiarity of coal soot, as foreign writers take no notice of its occurrence in countries where wood is used for fuel.—J. F. S.

(2) **Pott** says he never saw chimney-sweeper's cancer under the age of puberty. And **Earle** states:—"It very rarely attacks persons under the age of thirty, who form a very small proportion of the number engaged in the business. The greater proportion of cases which I have seen, have occurred between thirty and forty; I have seen three instances between twenty and thirty, and only one at the age of puberty. A solitary instance is recorded by my father, where it occurred in an infant under eight, but I have never met with any similar case." (p. 299.)

(3) I have lately had under my care a man, for whom my colleague, **Green**, removed a chimney-sweeper's cancer nineteen years since; the disease having recurred. The return of the disease seems evidently to depend on exposure to the cause which originally produced it, as so far as I am aware, if persons change their occupation, it does not recur, if removed before the glands have become tainted.—J. F. S.]

(*a*) Pharmacologia, vol. ii. London, 1825. 8vo. Sixth Edition.

(*b*) Med.-Chir. Trans., vol. xvii. 1832.

(*c*) **Earle**, Med.-Chir. Trans., p. 299.

H.—OF CANCER OF THE WOMB.

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2506. *Cancer of the womb* almost invariably commences in its neck, and in general upon the hind lip of its mouth. At first the symptoms are doubtful, and not distinguishable from any other irritable state of the womb. Most commonly menstruation is irregular, sometimes a sanious sanguinolent discharge, or a copious white discharge, with an uneasy sensation of tightness and dragging in the loins, frequent disposition to void the urine, *tenesmus* and darting stabs through the neck of the womb.

On examination, the vaginal portion is found partially or completely hardened, and in some parts loosened up. The mouth of the womb is also notched, irregular, and half open. On pressure with the finger, a sanious fluid mixed with blood flows out.

["In the great majority of instances," observes **Montgomery**, "the first discoverable morbid change, which is the forerunner of cancerous affections of the *uterus*, takes place in and around the muciparous *glandulæ* or vesicles, sometimes called the *ova Nabothi*, which exist in such numbers in the *cervix* and margin of the *os uteri*; these become indurated by the deposition of scirrhous matter around them, and by the thickening of their coats, in consequence of which they feel at *first* almost like grains of shot or gravel under the mucous membrane; afterwards, when they have acquired greater volume by further increase of the morbid action, they give to the part the unequal, bumpy, or knobbed condition, like the ends of one's fingers drawn close together. When this *second* stage (usually described by writers as the first) is established, all means hitherto devised have failed in producing any permanent benefit." (p. 439.)]

2507. The disease may remain in this state many months, and even years. The symptoms become more severe, spread over the *pubes* and thighs, the discharge becomes very ichorous, stinking, and mixed with pieces of slough and clots of blood; frequently there are very violent bleedings. The general health is much affected; all the symptoms of cancerous consumption, with the characteristic leaden countenance, make their appearance, and death ensues, either quickly, or after a severe bleeding, or as is usual, under the horrible tortures of hectic consumption (1).

On examination of this advanced state of the disease, the vaginal portion is found ulcerated, more or less destroyed, beset with warty growths and hard knots, which ascend into the cavity of the neck of the womb. Sometimes the womb itself, sometimes the upper part of the *vagina* is hard and degenerated; the ulceration may even extend to the *rectum* and bladder, in consequence of which the sufferings become more severe.

[(1) "The popular opinion, that cancer of the womb is invariably accompanied by acute suffering is," observes Ashwell, "certainly incorrect. But it is true that, in some instances, scarcely any infliction can equal, and certainly none can exceed, its agonizing, burning, and lancinating pain. * * * By most the pain is described to be lancinating, as though sharp knives were constantly being plunged into the neck of the womb; and so constant is this characteristic, that some authors found on it the *diagnosis* between corroding ulcer and cancer. There are, however, not a few cases in which the hot burning character constitutes its great aggravation. In the milder forms, where the progress is very slow, the pain is wearing and constant, but endurable." (p. 414.)

"These pains," remark Bayle and Cayol (*a*), "are sometimes so acute, that persons have been known to die of convulsions, or *delirium*, occasioned by cerebral fever." (p. 415.)

Montgomery (*b*) mentions an instance in which "the last five or six weeks of the patient's life were grievously embittered by the most uncontrollable and incessant *vomiting*, accompanied with slight pain and tenderness on pressure *over the stomach*, but *not in other parts of the abdomen*."

And Ashwell mentions a case, "where the malignant ulceration, commencing in the indurated deposit of the *urethra*, extended into the *vagina;* the aggravated pain was greatly alleviated by *belladonna* and *conium*, used topically; the appetite and health were so far improved, and the ravages of the disease so much checked for a considerable time, as to inspire the hope that a respite of at least many months might have been obtained. But just as these expectations were at their height, agonising pain suddenly and inexplicably recurred, and the patient sank in less than a week." (p. 384.)]

2508. Cancer of the womb, like cancer in general, exhibits many varieties in its progress; in persons with dense fibre, it is rather the progressive ulceration of scirrhous parts, but in pasty persons it is mostly accompanied with fungous growths and very copious bleedings.

The *diagnosis* is in general easy, and the more so as the practitioner is usually only first consulted when the disease has made some progress.

Those diseased conditions, which at first have some resemblance to cancer of the womb, but are easily distinguishable, are chronic inflammation and benignant hardening, steatomatous (fibrous) degeneration, eversion of the womb, polyp, and medullary *fungus*.

[The "*Cauliflower Excrescence from the Os Uteri*," as it is called by Dr. Clarke (*c*), is a form of disease by some regarded as truly cancerous, and by others as a morbid tissue, not necessarily of a malignant or carcinomatous nature. Upon this point Simpson observes:—"A number of circumstances appear to me to shew, that, in reference to, at least, the first stage of cauliflower excrescence, the opinion of these latter authors is probably correct. The occurrence of the disease in some cases as early as the twentieth year of life; its occasional shrinking, and almost total disappearance upon the application of a ligature, or after death; the frequent slowness of its general progress during life; the apparent absence of diseased deposits in the neighbouring tissues and parts upon the dead body; and above all, the alleged restriction, and even complete removal of the tumour in one or two instances, by the use of astringent applications and other

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(*a*) Quoted by Ashwell.

(*b*) Dublin Hospital Reports, vol. v. p. 434.

(*c*) Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. iii. p. 21. 1809.

simple means, form so many circumstances strongly pointing to the opinion, that in the earlier part of its progress, the tumour cannot be regarded as of a carcinomatous character. Has it any analogy in its pathological nature and origin—as it certainly has in its physical characters—with the soft warts and *condylomata* that sometimes form on the mucous membrane of the *vulva* and entrance of the *vagina*? These warts and *condylomata* have the same tendency to degeneration after their imperfect removal, and present to us a striking exception to the general pathological law of the local reproduction of a morbid growth being a sign of its malignancy. But whatever view we may take of the primary nature of the cauliflower excrescence of the *cervix uteri*, we have sufficient evidence for believing either that this disease has been often confounded with carcinomatous or medullary *fungus* from the *cervix uteri*, from the want of adequate diagnostic marks to distinguish them; or that, though non-malignant in its commencement, the cauliflower excrescence may, like some other local benign growths, become the seat of carcinomatous deposit and malignant action, during its progress." (p. 109.) May the degree of mobility of the *cervix uteri* serve in any case as a source of *diagnosis*? "The tendency of cancer," as observed by MÜLLER (*a*), "is to interfere with the natural structure of surrounding parts, while those formations which are of a benignant nature, leave the neighbouring healthy tissues unaltered." (p. 176.) In *carcinomata* of the *cervix uteri*, we thus generally find, even at a pretty early stage of the disease, that the organ has become more *fixed* and immovable than natural, in consequence of the morbid deposit affecting both the structure of the neck of the organ and the contiguous surrounding tissues. Does the reverse of this hold good with regard to cauliflower excrescence of the *cervix uteri*? (p. 110.)]

2509. Cancer of the womb may be developed at every period after puberty; it, however, most commonly appears between the fortieth and fiftieth years in women whose sexual functions have never been in proper order, and who have had much trouble and care. Mechanical injuries operating on the womb, rough treatment in delivery, constant irritation of the womb in its dropping down or protrusion; irritating astringent injections for flooding or for the whites, very frequent connexion, especially with disproportion of organs, as well also as frequent venereal excitement without connexion, and luxurious living at the climacteric period, must be considered as the most common and active causes of cancer of the womb. *Syphilis*, gout, and scrofula, are also frequently in causal relation with cancer of the womb; and hereditary disposition is not unfrequently noticed.

["Cancer is not often a disease of the young; although some years ago," says ASHWELL, "I attended a case with Dr. PIERCE, where the patient had not reached her twentieth year. BOIVIN and DUGES, in four hundred and nine examples, found twelve under twenty years of age; eighty-three, between twenty and thirty; one hundred and two, between thirty and forty; one hundred and six, between forty and fifty-five; and ninety-five, between forty-five and fifty. Mr. CARMICHAEL saw a case at twenty-one years of age; and WIGAUD adduces one of scirrhous *uterus* at fourteen years." (p. 375.)]

2510. The cure of cancer of the womb has been attempted by internal and external remedies, and by the destruction or removal of the diseased part.

2511. As to the employment of internal and external means, only in such cases may a favourable result be expected from them when the disease is not actually cancerous, but is simply benignant swelling and hardening, or that state of ulceration which, under neglect or improper treatment, may run into actual cancer. Hence, the successful issues which have been observed by means of proper antiphlogistic treatment, repeated application of leeches to the *sacrum* and to the upper part of the thighs, and in full-blooded persons even blood-letting, and at the same time the use of calomel, hemlock, *digitalis*, *belladonna*, *aqua lauro-cerasi* and the like, soothing baths and injections into the *vagina*, purgatives, and when

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(*a*) Neue Zeitschrift für Geburtskunde, vol. iv.

the cause has been syphilitic, properly managed mercurial treatment. In true *scirrhus* or cancer, the remedies directed (*par.* 2415) for cancer in general may indeed lessen the sufferings, but never effect a cure. This, as in cancer in general, so in cancer of the womb, is only possible by the *removal*, or by the *destruction* of the scirrhous or cancerous mass.

2512. It is self-evident that the circumstances already mentioned (*par.* 2410) as regarding operations on cancer in general, which either render them difficult, impossible, or contraindicate them, are still more weighty in reference to their application to cancer of the womb, as decision upon the extent of the degeneracy, and the participation of the patient's health, is subject to still greater difficulty than under other circumstances.

2513. Examination with the greatest attention can alone ascertain the condition of the womb, as well also as an inspection of the parts by means of the *speculum vaginæ* which must be passed into the *vagina* as high as possible, so that the neck of the womb may be received into its upper opening, which can alone be distinctly distinguished when the speculum is illuminated with a candle.

The specula *uteri et vaginæ* are rather conical cylinders of tin polished on their interior (Recamier, Dupuytren, Dubois and others); or two-armed (Lisfranc, Jobert, Duges, Ricord); or three-armed (Busch, Ehrmann, Weiss); or many-armed (Grillon Beaumont, Colombat.) The two-armed are usually most convenient.

The following circumstances are to be attended to in the introduction of the *speculum uteri*. The patient is to be laid opposite the light upon the edge of a bed or table, with her buttocks a little raised, and her feet supported by assistants, or resting on a stool. The practitioner standing between the thighs, separates with the fingers of his left hand the *labia*, and holding in his right hand the *speculum*, warmed and smeared upon its external surface with grease, passes the part next the *commissura labiorum posterior* some lines deep into the *vagina*, presses it upon the commissure, and at the same time raises the handle, so that the part resting against the *pubes* descends from the *urethra* into the *vagina*, and is carried to its very end. The two arms of the *speculum* are now separated by gentle pressure on the handle, and then by the admission of the daylight, or by holding a taper, the state of the vaginal part of the womb can be observed (*a*).

[Simpson (*b*) has made the following valuable observations, in reference to the mode of using the *speculum vaginæ*. "It is almost unnecessary, we believe, to insist at the present day, upon the importance of the early and accurate local examination of the *uterus*, in all cases of suspicious vaginal discharges. In some instances, examination by the finger may be sufficient, but in every doubtful case the *speculum* should likewise be resorted to, if there is any affection of the *vagina* or *cervix*. We have found it often confirming, and not unfrequently, also changing and rectifying the opinion which the mere tactile examination had led us to adopt. In this country great difficulties have been placed against the more general introduction of the *speculum* into practice, in consequence of the disagreeable and revolting exposure of the person of the patient, which is usually considered necessary in its employment. We have latterly in our own practice endeavoured to avoid this very natural objection, by teaching ourselves to introduce and use the instrument when the patient was placed on her left side, in the position usually ussumed in making a tactile examination, and with the *nates* near the edge of the bed. We strongly recommend our professional brethren to follow this plan, as by it, and with attention to the management of the bed clothes, we have found that the instrument can be perfectly employed with little, or indeed without any exposure of the body of the patient. The *speculum* is introduced easily without the assistance of sight, and the mouth of it only requires to be afterwards uncovered, in order to enable us to examine the *cervix uteri* and top of the *vagina*. We have made trial of many different forms of *specula*, and find, for almost all purposes that of Ricord by far the most manageable.

"In exposing the *cervix uteri* for the purpose of drawing blood from it by scarifications, in cases of chronic congestion and *metritis*, we have occasionally employed a tubular *speculum* with advantage, but even in this case the double-bladed instrument is

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(*a*) Lisfranc, Du Toucher; in his Clinique Chirurgicale; in Gazette Médicale, vol. i. p. 591. 1833

(*b*) Above cited.

equally useful, and in some instances preferable. In a case of ulcer of the *os uteri*, which we are at present attending with Dr. John Gairdner, and where the passages are much relaxed, and the *uterus* very low in the *vagina*, we have, on Dr. Gairdner's suggestion, employed with much advantage a short tubular *speculum* of only an inch and a half in length, and with a deficiency or opening along the course of one side of it, of sufficient size to enable us to pass our finger, for the purpose of placing the diseased part in the proper centre of the instrument. We have thus been enabled to touch easily the ulcerated surface with different applications; while with the usual instruments it was found a very difficult task to fix in this instance the very mobile *cervix uteri*." (pp. 105, 106).]

2514. Cases of successful extirpation of *prolapsed* and *everted* womb (*par.* 1289) first inclined B. Osiander to the performance of this operation for cancer of the womb, or rather of its lower part thus degenerated. Osiander has described two modes of performing this operation.

First.—The *fungus* is to be first removed, then the womb fixed in the bottom of the *vagina* by means of a thread drawn through its neck or by means of forceps, and afterwards the degenerated neck cut off by an arching cut with a curved, narrow, round-ended bistoury. The bleeding must be stanched by plugging, or by styptic powder.

Second.—If the greater part of the neck of the womb be destroyed by cancer, if it have spread far, and its cavity be filled with knobby, carcinomatous *fungus*, and the mouth of the womb cannot be seized and drawn down with needles, the patient must be placed in the horizontal posture, the womb thrust down by pressure on its *fundus*, which must be fixed in the cavity of the *sacrum* with the forefinger of the left hand, the middle and ring-fingers introduced into the cavity of the womb, and whilst they perform the cut with a pair of curved-bladed scissors, or an extirpating instrument, all the fungous irregular scirrhous parts are removed in small pieces. The cavity is then filled with sponge moistened in wine and styptic powder, and after the bleeding is stanched a sponge dipped in lead wash and vinegar is to be passed up. When suppuration comes on it must be encouraged by a mixture of extract of green walnut-shells, honey and red precipitate applied upon a sponge immediately to the surface of the wound. As the suppuration increases the mixture is to be used in smaller quantity and without the precipitate. At the same time, internal strengthening medicine must be given (*a*).

2515. Dupuytren's method is more simple and efficient. The patient having been placed in the same position as for lithotomy, he introduces the *speculum vaginæ* and gives it to an assistant to hold. He then grasps the neck of the womb with a pair of forceps, draws it slowly towards him, and cuts off the whole of the degenerated part of the neck of the womb, either with a double-edged bistoury curved towards its side, or with a pair of scissors curved in like manner, which are used above, below, and on both sides in such way that their concavity is always directed towards the neck of the womb. The bleeding in this operation is generally inconsiderable, though it may be great and even severe, in which case, if it proceed from any one single spot of the wound, that may be touched with a small actual cautery iron; but if the bleeding be from the whole surface, it must be stanched by tightly plugging the *vagina*. If inflammatory symptoms occur, corresponding antiphlogistic treatment must be employed. After suppuration is set up, four or six injections of warm water must be made, and afterwards a weak solution of chloride of lime thrown up. If

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(*a*) Reichsanzeiger. 1803. No. 300; p. 3926.—Göttinger gelehrter Anzeiger. 1808; p. 1300.

there be a luxuriant growth of granulations they must be touched with nitrate of silver. In two or three weeks at most the wound has scarred (*a*).

Canella (*b*) has given a peculiar *speculum vaginæ*, together with forceps and a curved knife, with which, when the neck of the womb is drawn into the cavity of the *speculum*, the degenerated part may be cut off.

J. Hatin (*c*) has also proposed a *speculum vaginæ*, which may be expanded at pleasure, and by it an instrument can be introduced into the cavity of the womb, for the purpose of fixing it, and then with a jointed uterotome the projecting part of the neck of the womb can be cut off.

von Walther, in a case, the account of which is still to be expected, first separated the pubic arch, and then cut off the neck of the womb.

When the neck of the womb, on account of its softening or destruction, will not permit the application of the forceps, the *vagina* and *peritonæum* must, according to Recamier, be cut into before and behind, and the womb then seized with the forceps, drawn down, and the degenerated part cut off.

Lisfranc (*d*) employs a *speculum vaginæ*, consisting of two half cylinders of tin connected by a hinge, and which may be separated from each other. After its introduction, the enlarged neck of the womb can be seen, and the necessary instruments introduced. With Museux's hook-forceps, made longer and stronger than usual, he seizes the neck of the womb, and with an artificial lever, acting for from five to fifteen minutes, produces a prolapse, and cuts off the degenerated part with a bistoury at several small strokes.

Colombat (*e*) has, for the purpose of preventing the pain in drawing down the womb, invented a hysterotome, with which, after the introduction of the *speculum vaginæ*, the neck of the womb can be seized and cut off.

Bellini (*f*) has invented a spoon, with a cutting edge in front and a long curved handle; and Cenulli (*g*) and Aronsohn (*h*) other instruments for extirpating the neck of the womb.

2516. When the degenerated neck of the womb is so soft that it cannot in any way be fixed without tearing, or when the disease recurs after it has been removed, its destruction by caustic is indicated. For this purpose Recamier uses nitrate of silver, and Dupuytren nitrate of mercury dissolved in nitric acid, and caustic potash, which is preferable.

Mayor's (*i*) practice of tying the neck of the womb with the assistance of forceps, must also be mentioned.

2517. The caustic potash is to be applied in the following manner:—The patient having been placed in the same posture as for excision, and the *speculum vaginæ* introduced, the cancerous surface is to be cleansed with a wad of lint, pressed against it with the forceps for a sufficient time. If the surface of the ulcer be irregular and beset with fungous growths, they must be removed with scissors curved towards their surface, or with a proper extirpation-knife. A wad of lint must then be placed below the surface of the ulcer, to suck up all the fluid part of the caustic which escapes during the process; the whole surface of the ulcer is now carefully dried with lint, and a conical piece of caustic potash, at least an inch broad at its base, blunt at its tip, and fixed on a holder, must be applied for at least a minute, unless the patient should suffer very great pain, which is rare. After this the *vagina* must be injected several times with water, the *speculum* and wad of lint removed, and the patient put

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(*a*) Sabatier, Médecine Opératoire, vol. iii. p. 597. 1824. New Edition.

(*b*) Cenni dell' Estirpazione della Bocca e del Collo dell' Utero et Descrizione del Metrotomo, etc. Milano, 1821.

(*c*) Mémoire sur un nouveau procédé pour l'Amputation du Col de la Matrice dans les Affections Cancéreuses. Paris, 1827.

(*d*) Coster, Manuel de Médecine Opératoire, p. 138.

(*e*) Mémoire sur l'Amputation du Col de la Matrice dans les Affections Cancéreuses, suivant un nouveau procédé; in Revue Médicale. 1828; vol. ii. p. 194.—Lisfranc, Mémoires sur l'Amputation du Col de l'Uterus, par Avenel; in Revue Médicale. 1828; vol. iii. p. 5, p. 199.

(*f*) Omodei, Annali Universali, vol. xlvii. p. 355. 1828.

(*g*) Archivo delle Scienze Med.-Fisiche Toscan. 1837; pl. i.

(*h*) Hamburger Zeitschrift, vol. i. part iv.

(*i*) Archives Générales de Médecine, vol. xvi. p. 91. 1828.

into a lukewarm bath. In four or five days, when the irritation has passed off, and the slough has separated, the operation is to be repeated in the same way, if the state of the parts seem to require it. Should symptoms of inflammation of the womb and of the *peritonæum* occur after the operation, strict antiphlogistic treatment will be requisite. This mode of practice, although it will not ever effect a cure, in most cases relieves the patient considerably (*a*).

2518. It is evident that this mode of treatment is alone indicated, and a cure thereby effected, when the disease is in its beginning, when there is not any accompanying general exciting cause, nor any ensuing affection of the whole consitution ; when the exhaustion is not very great, when there is not any affection of the neighbouring parts, and when the seat of the disease is such that the *whole degenerated part can be removed.* The result of the operation is, however, here just as doubtful, and even still more so than in the extirpation of any other cancerous part ; because, cancer of the womb is liable to escape the most careful examination of the extent of the disease. On the other hand, however, it must be remembered, that in cancer which arises in the neck of the womb, the boundary between the healthy and degenerated part is in general sharply defined, whereby the result of the operation can be the earlier determined, as cancer of the neck of the womb, as it is commonly developed, is a consequence of continued local ailment (*b*). Experience, however, is opposed to those who have denied the successful result of such partial extirpation (*c*). But a review of these cases proves that, on the other hand, the value of the operation has been overrated, as it brings about temporary, but very rarely lasting benefit, whilst fatal results have frequently ensued; and in the successful cases the correctness of the *diagnosis* may perhaps be doubted.

2519. Extirpation of the whole womb, if there be no accompanying prolapse, has by some been considered impossible; by others absolutely fatal ; by some holding out no hope of a favourable issue ; because in the case indicating it, the disease has so far advanced that no assistance can be expected from its extirpation (*d*).

Struve (*e*) proposed to effect a prolapse of the womb by drawing it down with forceps, separating the vaginal portion with a semicircular cut, tying the vessels, and freeing the womb from its ligaments.

Gutberlat (*f*) proposed extirpating the womb, having previously made a cut through the walls of the belly, in the *linea alba*.

C. Wenzel (*g*) proposes the extirpation of the whole womb, having first produced an artificial prolapse, by means of a pair of strong, toothed polyp-forceps, and then tying it with a ligature round its base, which is gradually tightened.

Langenbeck (*h*) undertook the extirpation of a protruded carcinomatous womb ; he dissected off the protruded *vagina* from its connexion with the womb, without cutting it through ; separated the *peritonæum* from the substance of the womb, till the upper edge of the base of the latter was freed from its peritonæal covering, which he then cut off in such way that a small healthy portion of its substance still remained attached. After this shelling, the *peritonæum* formed with the *vagina* an empty sac, which, when

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(*a*) Bulletin de la Faculté de Médecine. No. VI. Juin, 1819.—Patrix, above cited, p. 145.—Sabatier, above cited. — Wedemeier ; in Langenbeck's Neuer Bibliothek für Chirurg.und Ophthalmol., vol. ii. p. 576.—Ammon, Parallele der französischen und deutschen Chirurgie, p. 257.

(*b*) Canella, Giornale di Chirurgia Prattica. Aug., 1825.

(*c*) Siebold; in his Lucina, vol. i. p. 403.—Wenzel, C., Ueber die Krankheiten des Uterus. Mainz, 1816.—Zang, Operationen, vol. iii. p. 392. —Joerg, Aphorismen ueber die Krankheiten des Uterus, zur Würdegung zweier von Hofrath Osiander ; in Leipzig unternommenen Operationen. Leipzig, 1820.

(*d*) Pauly, Maladies de l'Uterus d'après les Leçons Cliniques de M. Lisfranc. Paris, 1836. —Pigné ; in his French translation of this Handbuch.

(*e*) Hufeland's Journal, vol. xvi. part iii. p. 123. 1803.

(*f*) Siebold's Journal für die Geburtshülfe, vol. i. part ii.

(*g*) Above cited.

(*h*) Neue Bibliothek für die Chirurgie und Ophthalmologie, vol. i. p. 551.

the bleeding was stanched, he filled with lint. The ovaries and round ligaments should be removed together with the womb.

Laud Wolf (*a*) extirpated a scirrhous prolapsed womb with a fatal result.

Recamier (*b*) successfully removed one by tying it. He also (*c*), in a case of cancer with prolapse of the womb, removed it, after ascertaining that no bowel was contained in the sac of *peritonæum*, by means of a needle carrying a double thread, and tied on each side.

2520. The assertion of the impossibility of extirpating the whole womb, has been disproved by a case in which Sauter (*d*) performed this operation successfully. He considers this operation, having never seen any cure by partial extirpation, as suitable and practicable, when there is in the *vagina*, around the neck of the womb, still sufficient space to allow the knife being carried around all the diseased part, and when no general symptoms exist which contraindicate the extirpation.

[That a patient can recover after extirpation of the womb, even under most unfavourable circumstances, is proved by the case related by Rossi (*e*), in which, after the delivery of both child and *placenta*, the midwife, on passing her hand into the *vagina*, felt a swelling, which she mistook for another child. This she pulled with such force, that the tumour, which was the womb, was dragged from its attachments, and then cut it off the *vagina* with a knife, and removed it entire. Notwithstanding this horrible treatment the woman recovered.]

2521. Sauter lays down the following rules for this operation :—After emptying the bladder and the *rectum*, the patient is laid across a bed and properly fixed. An assistant passes his hand over the *pubes*, in such way, that with the flat of it he can press down the womb into the *pelvis*, whilst with the back, the bowels are kept up and away from the *pelvis*. The operator introduces the fore and middle fingers of his left hand into the *vagina*, till they reach the hollow it forms around the neck of the womb; then carries a curved bistoury, with a short blade and long handle, between the fingers, up to this part, cuts through the *vagina* upon the womb, about two or three lines deep, and carries this cut around the whole neck. A pair of scissors, curved towards their edge, with long handles, are now passed between the two fingers, and a snip made between the bladder and *rectum* upwards through the *peritonæum*, keeping close to the neck of the womb, whilst with the fingers like a hook, the tough cellular connexions are grasped, directed into the scissors, and with these carefully cut through. When the division is so far made that the two fingers can be passed through the opening into the cavity of the belly, the separation may be made in a like manner between the *rectum* and womb, with scissors curved towards their blades, and kept close upon the womb. If the fingers can be passed on the hinder surface of the womb through the *peritonæum* into the cavity of the belly, this hinder connexion may be completely divided through the whole depth of its deeper sinking, up to its connexions on the sides, after the finger like a hook has been passed over the *peritonæum*, and that has been drawn down, with a concave knife or a pair of scissors curved on their side. The height to be separated should be about an inch. The further the hind connexion be separated from below upwards on the sides, the easier and safer can the operation be completed, after separating the connexions on the sides.

(*a*) Archives générales de Médecine, vol. x. p. 105. 1826.

(*b*) Revue Médicale. 1825; vol. iv. p. 393. December.

(*c*) Recherches sur le Traitement du Cancer, etc.

(*d*) Die gänzliche Exstirpation der carcinomatösen Gebarmütter, ohne selbst entstandenen oder künstlich bewirkten Vorfall vorgenommen und glücklich vollführt; mit näherer Anleitung, wie diese Operation gemacht werden kann; mit Abbild. in Steindr. Constanz, 1822.

(*e*) Il Raccoglitore.

2522. Thus far, by the introduction of the two fingers of the left hand into the *vagina* can everything be effected as to the management of the knife and scissors, but now the whole hand, or at least four fingers, must be passed between the urinary bladder and the womb up into the opening in the *peritonæum*, so that its inner surface may be turned back. Then with the fore and middle fingers, hooked, the highest connexion on one side being drawn down from above, and somewhat forwards, a concave knife is introduced, carried above the side connexions by means of the fingers, and then keeping close to the womb by continued supporting and carrying the knife with and between the fingers, the side cut downwards towards the *vagina*, is made, and afterwards in like manner on the other side, before the division of the former is completed. The remaining side connexions are now set free, for which the two fingers are alone needed, keeping close on the womb and endeavouring not to cut from the *vagina*, but continuing the division into the first-made cut in the *vagina*.

2523. If there be much bleeding, a wad of dry lint should be first passed into the *vagina*, then large pieces of German tinder placed round its wall within the *pelvis*, and the *vagina* plugged with either more German tinder or lint. If the bleeding require no attention, after a wad of lint has been passed into the *vagina*, dry lint, or mixed with gum-arabic, must be introduced, but the *vagina* is not to be plugged. The patient is then to be put to bed in the horizontal posture, and then the assistant removes his hand, which had prevented the descent of the bowels, from above the *pubes*.

The *after-treatment* must be conducted according to the general rules, with special attention, that the horizontal posture, with rest, should be continued for at least fourteen days, and if purifying injections into the *vagina* be necessary, they should be made carefully, so that nothing pass into the cavity of the belly. The *vagina* must never be stopped below with lint.

2524. VON SIEBOLD (*a*) has twice performed extirpation of the whole womb. He introduced a catheter into the bladder, so as more surely to avoid it, and then with SAVIGNY'S fistula-knife, divided upon two fingers behind the transverse branch of the share-bone, the right side of the vault of the *vagina*, close to the vaginal portion of the womb, and afterwards the left side. For the purpose of passing the whole hand, the *perinæum* must be cut through, so that the *ala vespertilionum* may be divided with the polyp-scissors to the very *fundus* of the womb. In the second case, after the division of the top of the *vagina*, a thread is passed by means of a flexible silver needle through the neck of the womb, for the purpose of preventing the recession of that organ. LANGENBECK (*b*) has extirpated the womb once through the *vagina*, and once by a cut through the white line, as proposed by GUTBERLAT. PALLETTA (*c*) extirpated the womb with a *sarcoma* attached to its neck ; in this case he drew the *sarcoma* inwards, cut into the upper part of the *vagina*, with a pair of long curved scissors, and completed the removal partly with them and partly with a sickle-shaped knife. HOLSCHER (*d*) proceeded in a like manner.

2525. BLUNDELL (*e*) made a cut into the hind part of the *vagina*, passed in two fingers to enlarge the opening, and then again used the bistoury to increase the cut on both sides to the root of the round ligaments. He

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(*a*) Beschreibung einer vollkommenen Exstirpation der scirrhösen nichtprolabirten Gebärmutter. Frankfurt, 1824.

(*b*) The same, p. 31.

(*c*) Journal VON GRAEFE und VON WALTHER, vol. v. part iii.

(*d*) The same.

(*e*) Above cited, p. 295.

then introduced his whole hand into the *vagina*, and two fingers through the opening in the *peritonæum;* upon these, a hook, which he fixed in the hind surface of the womb, and therewith drew it down, at the same time using the finger of the hand he had introduced as a blunt hook to act upon the *fundus* of the womb. In this way he brought the whole of the diseased mass near to the external opening of the *vagina*. He now cut off the ligaments and the Fallopian tubes close to the womb, and the *vagina* from the bladder with care, so as to wound neither its neck nor the ureters. The operation occupied an hour. Five months after the patient was well, well nourished, and perfectly cured. Blundell also undertook the extirpation of the womb in other three cases, but all were fatal.

Banner (*a*) seized the neck of the womb with a strong hook, drew it down, and fixed it with a loop carried through it. He then divided, with a semilunar cut, the hinder uppermost part of the *vagina*, where it is attached to the womb, and separated the womb from the bladder. The body of the womb was then turned forwards, and the ligaments were divided. The patient lost about six ounces of blood, and died on the fourth day.

2526. Delpech (*b*) considers a partial removal of the neck of the womb as never sufficient in any cancerous affection of the womb; as every mode of examining the extent of the diseased change is fallacious. Nothing but the complete removal of the womb can be of use. The dangers of this operation are, wounding the *peritonæum*, tearing the parts, bleeding, and especially tying the broad ligaments of the womb. All these dangers are greater in extirpating the swelling through the *vagina*, but less in that through the white line, where isolated tying of the vessels is possible. In one case, Delpech made a semilunar cut through the skin above the pubic *symphysis*, and another in its axis in the *peritonæum*. With one finger in the *vagina* and another in the wound, he passed a pharyngotome through the *vagina*, and thrust it through the upper wound, whilst a hollow cylinder kept up the *vagina*. He then passed an elastic sound, and a metallic loop, drew the broad ligaments into the tube, divided them, and tied the vessels singly. A loop was next carried round the womb, which was then cut off. The result was fatal, in consequence, as Delpech supposes, of the tying.

For the removal of the womb, whilst still in its place, Delpech gives the following directions: *first*, separation of the bladder from the womb through the *vagina*, after having passed a catheter into the bladder; the finger to be pressed up to the *peritonæum*, which must be penetrated with the finger-nail; *second*, a cut above the pubic *symphysis*, in which a semicircular flap is first formed through the skin, and the white line which is at its base being divided to the extent of five inches, the *peritonæum* lifted up with the forceps, and cut into; *third*, one finger being then passed from above downwards between the bladder and the womb, to the one or other side of the neck of the latter, raises the corresponding part of the bottom of the *vagina*, and with it the lateral ligament of the womb on that side into the wound. A cut is now made upon the finger or upon an elevator in its stead, from above downwards, and as each vessel is cut through it is tied. The other side is managed in the same way. The womb is then pulled forwards, and its connexion with the *rectum* divided, and a sponge passed into the *vagina*.

(*a*) London Medical Gazette, vol. ii. p. 582. 1828.

(*b*) Mémoire sur l'Ablation de l'Uterus; in Memorial des Hôpitaux du Midi. Oct., 1830; p. 695.

2527. According to Dubled (*a*), after the neck of the womb has been seized and drawn down to the entrance of the *vagina*, the upper and fore part of the latter must be cut through, the opening enlarged with the finger, and the *peritonæum* stripped off; and the same must be done on the hind part. A ligature is then passed over the free edges of the lateral ligament, and that part of the latter surrounded which encloses the vessels of the womb, after which the lateral ligaments are cut through. The womb is then easily thrust down, and its diseased part cut through by a transverse cut, without interfering with its *fundus*. The patient died twenty-two hours after this operation.

2528. Recamier (*b*) proposed a mode of proceeding, which like that of Sauter is specially distinguished by avoidance of bleeding, and in one case with success, the patient being cured on the forty-third day. Clysters were given on the evening and morning before the operation. The patient was placed as in the operation for the stone, and the neck of the womb having been seized with Museux's forceps, was drawn down as low as possible. The *vagina* was then cut through with a convex button-ended bistoury, introduced on the left forefinger, on the fore and under part of the swelling. The cellular tissue between the bladder and womb was separated with the left forefinger up to the folds of the *peritonæum*, and the convex bistoury passed along the finger, following the upper surface of the womb, opened the *peritonæum*, into the cavity of which the finger was introduced upon the body of the womb. With a straight button-ended hernial knife, introduced in the same way, this opening was enlarged right and left, till two fingers could be readily placed upon the body of the womb, so as to bear it more forcibly down. With the same knife the two upper thirds of the left broad ligament were cut into close to the left side of the womb, and immediately after the right broad ligament in the same way, the left forefinger carrying in the bistoury. The left forefinger was now passed behind the remainder of the right broad ligament, and the thumb placed on its outer and fore part, so that with these fingers it was grasped, and a thread carried round it with a needle having a stem and an eye at its point. In this part of the ligament the uterine artery was found, taken up and tied moderately tight with a loop-tier. The same was afterwards done on the left side. The left forefinger being now placed behind and the thumb before the ligature, the rest of the broad ligaments were cut through with a button-ended bistoury, carried close to the side of the womb, whilst the fingers protected the ligature. The same was afterwards done on the left side. The womb being now thrust out of the *vagina*, the bistoury was carried between the womb and the *rectum*, upon the fold of the *peritonæum*, and divided it, and the edge of the knife being directed obliquely from above downwards, and from before backwards, cut through at last the upper and hinder part of the *vagina*. Both loop-tiers were now turned upwards, and with their threads laid upon the *pubes*. If the *omentum* or bowel protrude, they must be carefully replaced; and the perfectly horizontal posture of the patient will prevent its recurrence. The urine must be drawn off with a catheter, and the treatment must correspond to the symptoms which occur. If the suppuration be of bad kind, careful injections of lukewarm water should be used.

In dividing the upper third of the broad ligament, the little artery of the ovary cannot, according to Recamier, well give rise to bleeding on account of the extension

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(*a*) Journal Hebdomadaire, vol. vii. p. 123.

(*b*) Above cited, vol. i. p. 519.

of the ligament, and if it be not divided with a very sharp bistoury. This part may be compressed with the finger, torn, and even a thread carried round it with a much-curved needle. The ligaments of the womb should always be cut through gradually, so that the divided parts may be kept close to the external pudic aperture. Roux has extirpated two cases of cancerous womb in this way. Both died on the second day.

2529. It is superfluous to speak particularly of the difficulty of this operation, and of the dangers which may follow it. Of all the cases mentioned in the preceding paragraphs, the whole excepting Sauter's, Blundell's and Recamier's, had a quickly fatal result, and even in these three cases the consequences were not permanent. Sauter's patient had a vesico-vaginal fistula, and died four months after of exhaustion and consumption; Blundell's died within the same year of cancer of the *vagina*, and Recamier's patient can scarcely stand or walk, so doubtful is the permanent result. But without it, according to our present knowledge, those who suffer from cancer of the womb, are certainly doomed to a most painful death. Of the several modes of practice described, that of Recamier seems to be the best.

Gendrin (*a*), after having collected all the known cases of extirpation of the womb, proposes the following mode of extirpating the womb, by which he endeavours specially to ensure stanching the blood, and lessening the painful dragging in bringing down the womb, as he considers that nearly in all the cases which have died in the first two days, death has not been caused by the inflammation, but by the depression of the powers from the pain in dragging down the womb during the operation.

The patient is placed as in the operation for the stone, and a wooden gorget introduced into the *vagina* for the purpose of pressing aside any excrescences at the neck of the womb, and fixed at the highest part of the *vagina* on the right edge of the neck of the womb. Upon this gorget a bistoury wrapped in linen to within six lines of its tip, the extremity of which is covered with wax, or a pharyngotome is pushed to the upper part of the *vagina* six lines deep from below upwards, and from behind forwards, so as to pass into the broad ligament of the womb. A blunt-ended hernial knife is now carried into this little opening and enlarges it from above downwards in the wall of the *vagina* to the length of eight or ten lines according to the extent of the disease. After removing the bistoury and gorget, the hand is passed into the *vagina*, and the forefinger into the wound; the uterine artery is found along this cut in the upper third of the *vagina*, six lines in front, at the bottom of the triangular space forming the boundary of the connexion between the *vagina* and bladder. The parts are to be separated either along the cut or further up, where it is distant at least ten lines from the *vagina*, so as to get at the womb in the broad ligament. A ligature can then be passed round the womb either with a blunt, curved, aneurysmal needle, or what is easier with a thickish leaden thread, to which a ligature is attached and held by its outer end. If it be not possible to get hold of the artery alone, it may be compressed with the wall of the *vagina* by a plate of lead. The same is to be done on the left side. A button-ended bistoury very concave on its cutting edge is now passed into the cut on the left side, with which the wall of the *vagina* is divided horizontally to the right; the instrument must be supported by the right forefinger, introduced half its length into the *vagina*, and the handle managed with the left hand. The front wall of the *vagina* is now divided and both the side cuts connected. If the operation be performed high up, the *vagina* and *peritonæum* may be divided together, before and behind, by two transverse cuts. If the *peritonæum* be not at the same time divided, a pharyngotome is carried deeply into one of the two side cuts at the back of one broad ligament through the *peritonæum*, which after having been previously stripped off as far as possible with the finger, is to be divided with the hernial knife, first behind and afterwards before; and in doing this the whole left hand must be employed for using the knife in the *vagina*. A double hook or a pair of hook forceps are now fixed in the body of the womb, which must be drawn gently down, without bringing it into the *vulva*. The whole hand having been passed into the *vagina*, is pushed into the cavity of the belly, the hernial knife carried behind the right ligament of the womb, which is made tense, the body of the womb being drawn to the left by the hook, and the broad ligament divided from

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(*a*) Observations et Remarques sur l'Extirpation de l'Uterus; in Journal Général de Médecine, p. 91. 1829. Oct.

behind forward, whilst the bowels are kept back with the fingers. The other side is to be managed in the same way drawing the womb to the right. The womb must now be twisted obliquely on its axis, and gradually withdrawn.

[*Excision of the Uterus by the Abdominal Section*, was performed by Heath (*a*) of Manchester, with the long incision "from a little below the ensiform cartilage to within an inch and a half of the *symphysis pubis*," under the supposition, that the disease was an ovarian tumour. The opening of the *peritonæum*, however, immediately showed its true character, and its removal was determined on. Two double ligatures were passed, by means of a sharp-pointed aneurysm-needle, through the *cervix uteri*, immediately below the circumference of the tumour. Each ligature was then firmly tied, so as to include one half of the neck of the womb and broad ligaments. The parts were then excised and removed. No bleeding ensued from the cut surface; indeed, throughout the operation not more than three ounces of blood were lost; and after the division of the skin, few complaints of suffering were made by the patient herself." Soon after the operation vomiting came on, with severe pain about the *umbilicus*, to relieve which, two grains of opium with five grains of carbonate of ammonia were first given, and three hours after a starch clyster with two grains of acetate of morphia. She became more comfortable afterwards, had some sleep, and the pain in the belly subsided. Twelve hours after the operation, she began to complain of the heat of the room; two hours after she began to sink, and continued to do so till seventeen hours from the operation, when she died. Fourteen ounces of blood were found in the cavity of the belly. This operation was commenced under the notion of the disease being an ovarian tumour, and the large cut having been made, it was thought advisable to remove the tumour though belonging to the womb.]

(*a*) London Medical Gazette, vol. xxxiii. p. 309. 1844.

SIXTH DIVISION.

LOSS OF ORGANIC PARTS.

2530. The loss of organic parts is either the consequence of external injury, of operations, or of destroying ulceration; or it is a congenital misformation. The means for the removal of such misformations, or for restoring the functions of lost parts *(Chirurgia Anaplastica)* are of two kinds,

ORGANIC RESTORATION, or
MECHANICAL APPARATUS.

I.—OF ORGANIC RESTORATION OF LOST PARTS.

TAGLIACOTIUS, De Curtorum Chirurgia per institionem. Venet., 1597.

ROSENSTEIN, De Chirurgiæ Curtorum possibilitate. Upsal, 1742.

DUBOIS et BOYER, Dissert. Quæst., An curtæ Nares ex brachio reficiendæ? Paris, 1742.

CARPUE, J. C., An Account of Two successful Operations for restoring a lost Nose from the integuments of the forehead; with Remarks on the Nasal Operation. London, 1816. 4to.

GRAEFE, C., Rhinoplastik, oder die Kunst, den Verlust der Nase organisch zu ersetzen. Berlin, 1818; mit sechs Kupfertaf.

SPRENGEL, W., Geschichte der chirurgischen Operationen, vol. ii. p. 185. Halle, 1819. 8vo.

GRAEFE, C., Neue Beiträge zur Kunst, Theile des Angesichtes organisch zu ersetzen; in Journal für Chirurgie und Augenheilkunde, vol. ii. p. i.

DELPECH, Chirurgie Clinique de Montpellier, vol. ii.

DIEFFENBACH, Chirurgische Erfahrungen, besonders über die Wiederherstellung zerstörter Theile des menschl. Körpers nach neuen Methoden. Berlin, 1829-38.

LABAT, De la Rhinoplastie, Art de restaurer ou de refaire complètement le Nez. Paris, 1834.

BLANDIN, Autoplastie, ou Restauration des parties du Corps, qui ont été détruites, à la faveur d'un Emprunt fait à d'autres parties plus ou moins éloignées. Paris, 1836.

ZEIS, Handbuch der plastischen Chirurgie. Berlin, 1838.

SERRE, Traité sur l'Art de restaurer les Difformités de la Face selon la Méthode par déplacement ou Méthode française. Montpellier, 1841; avec un Atlas.

DIEFFENBACH, Operativ Chirurgie, vol. i. p. 312.

VON AMMON und BAUMGARTEN, Die plastische Chirurgie nach ihren bisherigen Leistungen. Berlin, 1842.

LISTON, ROBERT, Practical Surgery. London. Fourth Edition, 1846. 8vo.

MÜTTER, THOMAS D., M. D., Cases of Deformity from Burns successfully treated by Plastic Operations. Philadelphia, 1843. 8vo.

——————————, Cases of Deformity of various kinds successfully treated by Plastic Operations. Philadelphia, 1844. 8vo.

FERGUSSON, WILLIAM, A System of Practical Surgery. London, 1846. 8vo. Second Edition.

2531. History points out the methods of organically restoring the lost parts of the face, especially of the nose, the mutilations of which disfigure most horribly, under three distinct classes. Either the neighbouring skin, especially that of the forehead, is made use of; or the skin of the arm, *whilst still remaining connected with its original seat*, till it has become organically connected with the part on to which it has been transplanted; or the transplantation of a *completely detached piece of skin* upon the part to be supplied.

The ancient bad practice of restoring old divisions and clefts of the nose by drawing together their edges fresh pared and detached to some extent, or by encouraging granulation must be distinguished from restoration by transplanting.

2532. The origin of organic restoration is lost in the earliest periods of Indian history, and appears to have been preserved from age to age in certain castes, especially the Koomas or Potters. In India, where many criminals are punished by cutting off the nose, ears, and lips, the frequency of such mutilations has manifestly led to this operation. The peculiarity of the *Indian Method* is, that the flaps of skin necessary for the restoration are formed *from the skin of the forehead.*

About the middle of the fifteenth century, the art of restoring lost noses was found in Sicily, in possession of the family of BRANCA, from whom it passed into Calabria, to the family of BOJANI, but with the end of the sixteenth century it was entirely lost. About the same time it was practised by CASPAR TAGLIACOZZI, of Bologna; he wrote a special work on the subject, and brought it into great repute. It is doubtful whether this operation was brought from India to Italy, perhaps by the Arabs or by the missionaries, or whether it originated in Italy itself. The characteristic of the TAGLIACOZZIAN or *Italian Method*, is the formation of the restoring flaps *from the skin of the arm*, which, after a preparatory management, are attached to the seat of transplantation. TAGLIACOZZI had but few followers; his scholar CORTESI described his master's and his own somewhat modified operation in 1625; GRIFFON performed it twice, MOLINETTI once, and THOMAS FIENUS gave an extract relating to it from TAGLIACOZZI's work. For a long while after, this operation sunk into disuse, since by most people it was held to be inapplicable or fabulous, and many no longer thought about it. Yet in India it was still practised, even by an English Surgeon named LUCAS, who had learnt it from the Indian operators, and was successful; and in England it was performed by LYNN, in 1803, and by SUTCLIFFE (*a*), though by both unsuccessfully. In 1814, however, it was first performed with good result by CARPUE, in two cases which he has described in his Paper. In Germany, GRAEFE made use of the Italian method in 1816, but subsequently the Indian mode; he also modified the Tagliacozzian operation, as had been previously proposed in 1721 by RENEAULME DE LA GARANNE (*b*), in which he connected the flap, formed from the skin of the arm, without waiting for the complete skinning over of the inner edge, to the refreshed stump of the nose; and this was distinguished as the *German Method* of Rhinoplasty. Although GRAEFE has introduced many niceties and complications, he has, however, contributed much to the real improvement of this operation, and must be considered as the actual creator of Plastic Surgery in Germany. His example had quickly numerous followers. REINER, TEXTOR, myself, RUST, VON WALTHER, BECK, DZONDI, FRICKE, and others. Rhinoplasty was not alone actually improved and simplified, but Plastic Surgery was extended to the restoration of eyelids, lips, and the like. The most important services in this respect have been rendered

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(*a*) CARPUE, above cited, p. 41.

(*b*) Histoire de l'Académie des Sciences. 1721.

by **Dieffenbach**, who has devoted himself to this branch of Surgery, with peculiar zeal, and has contributed, by numerous clever operations for various mutilations, to the establishment of Plastic Surgery. In England, since **Carpue**'s time, Plastic Surgery has found little sympathy (1). **Hutchison** only, in 1818, and **Davies** in 1823 (*a*), have performed Rhinoplasty. In France, **Delpech**, in 1818, had performed plastic operations for the restoration of the *scrotum*, of the lips, and of the nose, at first according to the Italian, and subsequently after the Indian manner. After him followed **Mouleau** and **Thomain**, but by **Dupuytren**, **Lisfranc**, **Martinet**, **Velpeau**, **Jobert**, **Labat**, and **Blandin**, numerous operations were performed for the restoration of the nose and other missing parts, and new methods were described.

It is, however, remarkable, that in the greater extension of Plastic Surgery, from it being thus generally taken up, the restoration by means of a detached piece of skin, the Italian method has been rather avoided, and that by flaps from the neighbouring skin, the Indian method, generally preferred.

In Germany, **Graefe** (*b*), **Dzondi** (*c*), **Bunger** (*d*), and others, have performed that described as the *second Indian method*, in which, after beating a portion of the skin of the rump with a wooden shoe till it has swollen considerably, a triangular piece with the cellular tissue is cut out, placed on the stump of the nose, the edges of which have been previously refreshed, and there fixed (*e*); **Bunger**'s operation, however, was the only one which succeeded. This operation is very rarely performed, as the completely detached skin has rarely sufficient life for organic connexion (*f*).

[(1) **Chelius** is in error on this point; Plastic Surgery has not been so much neglected in England as he seems to imagine, and there are few Hospital Surgeons who have not more or less frequently made new, or mended old noses, made new lips, and inserted pieces into eyelids, attempted the restoration of *urethræ*, in which large portions of the canal have been exposed, either by original misformation, or from disease, and transplanted pieces of skin to supply the place of scars from burns. In but few instances, however, have the operators thought them of sufficient importance to give to the public, which may account for foreigners being unaware of Plastic Surgery being much practised in England, though probably not so many rhinoplastic operations at least, are performed here as abroad, perhaps for the reason that loss of nose is with us of not very common occurrence, since our syphilitic treatment has been improved. To which may be added as another reason, that our young men are not in the habit of amusing themselves with slicing off each other's noses in sword duels (*g*).—J. F. S.]

2533. The following may be generally distinguished as the methods of reparation by a fold of skin from the neighbourhood, either fixed only by its edges, or by contact of its inner surface, which have been proposed in modern times (*h*):—

α Formation of a flap with a neck, upon which it is twisted round.

β In-healing of a bridge of skin, in which the cut forming the bridge is carried uninterruptedly in the wound formed by its removal, and the flap twisted upon the whole thickness of its stem.

γ Removal of the flap, in which one of its edges is attached to the edge of the part to be supplied, the loosened flap being carried over the lost part.

(*a*) London Medical Repository, vol. xxi. p. 39. 1824.

(*b*) Rhinoplastik, p. 8.—Jahresbericht über das chirurgische und augenarzbeliche Institut zu Berlin. 1819; p. 411.

(*c*) **Rust**'s Magazin, vol. i. p. 8.

(*d*) Journal von **Graefe** und von **Walther**, vol. iv. p. 559.

(*e*) Gazette de Santé, No. IX. 1817.—**Hufeland**'s Journal, vol. xxxvii. part v. p. 106. 1817.

(*f*) For the complete history of Plastic Surgery, see **Zeis**, above cited.

(*g*) **Dieffenbach**, above cited, part i. p. 22; part ii. pp. 84, 85. 1845.

(*h*) Compare on these subjects **Dieffenbach**, **Blandin**, **Zeis**, and others.

δ Drawing over the skin.

ε Lifting up sunken parts, as of the nose.

ζ Implanting, for the restoration of a partially destroyed part, for instance, the bridge of the nose, and the like.

η Overplanting, by which a nose rendered irregular and jagged by some destroying disease, is covered or overlapped by a flap from the skin of the forehead.

θ Underplanting, for the purpose of supporting the sunken parts, when the bridge of the nose has quite dropped in, by undersetting a flap of skin from the forehead.

κ Rolling together a flap, with the object of filling up deep and wide fistulous passages.

λ Unrolling rolled-up flaps for the purpose of closing openings which have been made by their separation.

μ Sewing over with mucous membrane, of parts disposed to unite, to prevent their union.

ν Doubling the edges of the skin to prevent the crumpling of transplanted flaps.

ξ Fixure by holding.

ο Removal of the skin, in which a flap of skin is again fixed in its place by holding, especially for the better formation of noses which have been attached.

π Transplantation by gradually moving the flap onwards.

ρ Transplantation by removal of the flap.

2534. The value of plastic operations must in general be considered very great, especially as regards the numerous effectual improvements, which have been recently practised, and as by them not merely is a congenital defect provided for, but even the restoration of any important function, and the removal of any very serious inconvenience is effected, as for instance, in the restoration of eyelids, and of wanting lips, in the closure of vesico-vaginal fistulæ and the like. In those plastic operations, however, in which the removal of deformity is the principal object, as for example, the formation of a nose, the danger of the operation, the possibility of complete failure, or an imperfect result, and the probability of the restoration being always imperfect, and very unlike the original organ, must be well considered.

Rhinoplasty is always a very painful operation; it may cause a violent attack of erysipelas, nervous symptoms, and even death. The healing of the flaps can only be expected with good state of the general health, with the removal of every dyscrasy, with proper condition and vitality of the skin, where it is not very thin, very lax, very sensitive, and the part upon which it is implanted is not very tough, hard, or altered by scars, or in any other diseased manner. Scrofulous subjects generally afford the most unfavourable *prognosis;* but according to Blasius, this does not apply to *lupus*, as he has performed rhinoplasty with the best result, whilst that disease has still existed on other parts of the face. I have, however, seen a case belonging to another practitioner, in which the *lupus* spread to the restored nose, and produced horrible deformity. In defects from accident, and in syphilitic destruction of the nose, when the disease is completely extinguished, the *prognosis* is most favourable. Death of the flap may result from deficient nutrition, and also from excessive influx and congestion of blood.

Although the cure of the nose be completed, yet in progress of time very considerable changes may take place in it which will materially change its previous form and condition. If the nose have at first a tolerable shape, yet it may gradually shrivel, especially on its two sides and upper part, the granulations which were developed on its interior becoming at last connected on both sides, so that the two halves of the nose grow into one solid mass, by which its root shrinks, whilst its fore part thickens, the nostrils contract, and are almost entirely closed at the end. Such shrivelled noses in no respect resemble the engravings which have been given of them soon after the operation, and are as remarkable in their form, as they are disfiguring. All endeavours by subsequent attempts, to improve the shape of the nose, are generally fruitless, although experience proves that wounds in such new noses are easily cured by adhesion, but union with the neighbouring skin usually cannot be effected, and commonly takes place only after long-continued suppuration. These circumstances require serious consideration in settling the value of many plastic operations, and specially that of rhinoplasty, in order to guard against the excessive enthusiasm which this operation has excited among many of late; and these are the circumstances which have led some practitioners, as KLEIN (1), to prefer mechanical to organic restoration of the nose.

(1) KLEIN (*a*) considers an artificial nose of lime wood preferable to one made from the skin of the forehead.

2535. As regards preference of the various modes of organic restoration, and specially of the nose, putting aside the totally ineffectual transplantation of a completely separated portion of skin (1), and the employment of the skin of another individual, that method is to be generally preferred in which the restorative flaps are obtained from the neighbourhood rather than that by which they are obtained from a distance. The Indian mode is for the patient far less painful and its result more certain than the Italian method, and if the nose-bones be deficient, the vault of the nose may be tolerably supplied with a pad formed by turning in the flaps. The scar remaining on the forehead, which has been objected to in this method, generally disappears, so that little or no deformity is produced. Only when the skin of the forehead cannot be used may the restorative flaps be made from the skin of the temples, which, although it be more substantial, and its connecting strip be longer, and usually sufficient for nourishment, yet is a much more considerable injury, and the hairs growing upon the nose cannot always be completely eradicated, as is supposed, by repeatedly pulling them out. The skin of the cheeks and upper lip can only be used in partial defects of the sides of the nose. The German method as given by GRAEFE, is indeed less tedious than the Italian, but succeeds only in very healthy persons with very healthy skin. But the cure by fastening the arm to the head subjects the patient to the same annoyance; the flaps die more readily, and if suppuration ensue on its cellular surface the difficulty is further increased by its spreading over the surface.

[(1) Simply paring the edges of a destroyed nose and transferring a detached portion of skin from some other part of the body, is probably not very likely to succeed, as the mere edges of the wounds can hardly be expected to afford sufficient surface for the shooting of vessels speedily enough to nourish the whole flap. But there is no doubt that if two tolerably large wounded surfaces, one of which belongs to a detached part, can be closely applied, union will take place, and ugly scars, no less than tedious sores, will be prevented. The following are curious examples of this fact:—

(*a*) Ueber Rhinoplastik; in Heidelb. klinisch. Annalen, vol. ii. p. 103.

Balfour (*a*) has given two interesting cases, in one of which, parts all but completely. and in the other, parts completely divided, were reunited by simple replacement; and hence he thinks, " that the practice of attempting the reunion of separated parts, may be carried farther than has ever yet been done." (p. 425.) In the first case, a boy had " the joints of three of his fingers completely separated, with the exception of a slight attachment of skin, which barely suspended the parts, in consequence of having had them shut into the groove of a door." The points hung at right angles when the fingers were extended. The point of the index was cut off at the middle of the nail, the next finger a little above the nail, and the ring-finger at the root of the nail. The wounded surfaces were necessarily much bruised, but cut perpendicularly." * * * On the sixth day after the accident, I removed the bandages, when I found adhesion had taken place. The skin and nails came off all the three fingers, but were afterwards renewed; and the cure was so complete, that a narrow inspection was necessary to discover any difference between the fingers of the one hand and those of the other. There was, indeed, no difference to be perceived, but a slight scar ont he left side of the ring-finger at the root of the nail." (p. 426.) The second and most remarkable case is that in which by one stroke of a hatchet, half the index was cut off; " the wound began near the upper end of the second phalanx on the thumb side, and terminated about the third phalanx on the opposite side. The amputated piece, as measured by the patient himself, (a carpenter,) was an inch and a half long on the thumb side, and an inch on the other." The amputated portion was fetched from the shop where it had been left; was white and cold, and looked and felt like a bit of candle. * * * " I poured a stream of cold water," says **Balfour**, " on both wounded surfaces, to wash away the blood from the one, and any dirt that might be adhering from the other. I then applied, with as much accuracy as possible, the wounded surfaces to each other, expressing a confident expectation that reunion would take place." (pp. 426, 27.) This was done twenty-five minutes after the accident. Two days afterwards the man insisted on having the bandages removed, and " adhesion had taken place." Since that time the finger " recovered both heat and sensation. In the progress of the cure, the skin was changed, and, soon after the accident, the nail fell off." (p. 428.)

Braid (*b*) also mentions a case in which (on 13th June, 1816) " a hatchet cut off a portion of the forefinger of the left hand in an oblique direction, carrying off all the nail, except a small portion of its root on the ulnar side, together with the soft parts on the anconal and radial aspect, to a little above the first joint. The bone was denuded, but not divided. He came from a considerable distance. Finding on inquiry, that he had left the detached piece, I returned with him, and found it covered with dust. After having washed it with warm water, I applied and retained the divided part in its former situation by straps of adhesive plaster, &c. * * * On the 17th adhesion had taken place completely. * * * On the 20th he had the sense of feeling even from a small pointed instrument applied gently to the part which had been detached." The skin and nail separated, " and in a month from the time he met with the accident, he was able to follow his work as a miner, and in five weeks could use his finger in tying threads whilst weaving. The nail has made considerable advance in growth."

The truth of these statements I had the opportunity of verifying about the time of **Braid**'s case. A lad came to St. Thomas's Hospital during my dressership, with a slice cut off from the front of the top of his thumb, to about the middle of the last phalanx. As the cut was very clean, and the part detached ready to hand, as he had brought it with him, it was too good an opportunity to miss making the experiment. The piece was therefore cleansed, carefully applied, and fastened with straps of plaster. A few days after, how many I do not recollect, the dressing was removed, and the greater part of the detached piece had adhered. The cuticle separated, and a part of the thin edge sloughed, but at least two-thirds of the whole piece remained firmly united.

Barthelemy (*c*) mentions instances in which portions of skin sliced off accidentally from the toe and finger, adhered readily. In another case, the tip of the nose cut off by a sabre stroke, also united. But he relates a still more remarkable instance, on the authority of **Regnault**, principal physician to the Military Hospital at Gros-Caillou, in which during a fight between two prisoners at Niort, a large piece of the nose of one

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(*a*) Two Cases, with Observations demonstrative of the Powers of Nature to reunite parts which have been, by accident, totally separated from the Animal System; in Edinburgh Medical and Surgical Journal, vol. x. p. 421. 1814.

(*b*) Case of Reunion of a separated Finger; in Edinburgh Medical and Surgical Journal, vol. xii. p. 428. 1816.

(*c*) De la Réunion des parties entièrement séparées du Corps; in Journal Hebdomadaire de Medecine, vol. v. p. 15. 1831.

was bitten off by the other; five hours after, it was replaced by the Surgeon of the prison, and in about ten days it was firmly united.

I am not quite so sanguine as **Balfour** was, who thought such treatment might be advantageously employed in many wounds or rather slicings received in the field of battle; but still I should feel disposed to make the attempt again, under similar circumstances, as even if a portion only of the detached part adhered, there would be less of the granulating process required, and therefore the cure would be more quickly effected. —J. F. S.]

OF NOSE-MAKING FROM THE SKIN OF THE FOREHEAD.

2536. In the Indian method of Rhinoplasty, which premises, that the skin of the forehead should be healthy, perfectly movable, sufficiently thick, and free from scars and eruptions; a model of wax or fine clay is required, which should fit accurately, be handsome, and correspond to the form of the person's face. This is to be placed immediately on the stump of the nose, and held there firmly, whilst with a fine miniature brush, dipped in some not very soluble varnish, the base to which the artificial nose is to be attached is carefully marked with a line. In this way are mapped the longitudinal cuts on the sides of the nose, and the transverse one for the *septum*. The longitudinal cut, for refreshing the edge, should be begun at the upper part of the stump of the nose, close to where, after twisting round the flap of skin, the fixing of its side edge must begin; the two side cuts must not unite at top. All the dimensions of the model having been sketched on a piece of paper, so that its entire surface be obtained, the shape is to be cut out of paper and placed upon the forehead, the *septum* above and the root of the nose below, between the eyebrows, but less low down, and with the coloured varnish a line marked round it. If the forehead be low, and the figure would fall upon the hairy part of the head, it must be placed obliquely. Where at bottom the side cuts are about five lines apart, they must be continued straight down to the root of the nose, to mark the bridge of skin. The suture points are now to be marked, first around the nose-stump, two on the upper point of the side cuts, a line and a half outwards, two on the lower end of both side cuts, and opposite each other between these the spaces for the other suture points are easily found. Al these have been marked upon the paper model, and from it transferred t the forehead.

As in the directions above given by **Graefe**, the lines and points marked wit coloured varnish are easily obliterated during the operation, a model of the flap o skin should be cut out of sticking plaster, fixed on the forehead, and the flap made b cutting round it, but a quarter or third of an inch larger (**Dieffenbach.**) As the fla always shrinks considerably, care must be taken that it be not made too small; th *septum* especially must be broad, because, during the scarring process, its edges dra back and it easily becomes too narrow. A model for comparison may be found i **Zeis** (*a*), from **Graefe**, which also lets the *septum* run into a triangle, for the purpos of assisting the union of the wound in the forehead. **Delpech**'s recommendation, t allow the flap to run into three long points, so as to render the union of the wound o the forehead more easy, does not answer the purpose, and can only be sufficient fo supplying the deficient tip of the nose. In some cases **Dieffenbach** has formed a oval flap of skin from the forehead, which method will be presently more particu larly described. That the skin of the forehead should be rubbed in with some aro matic spirits daily for six or eight days before the operation, unless tension and pai ensue, (**Graefe**,) is superfluous.

2537. The operation is to be now begun by paring the edges of th

(*a*) Above cited, p. 267.

stump of the nose; or, if there be no stump, by making grooves in the skin close to the opening of the nose. In the first case, the edges are to be cut sore, whilst held with hook forceps, and the cut is to be carried through the whole thickness of the nose-stump. As much as possible of its substance is to be preserved; but both sides must be made as near alike as can be. If a part of the wing of the nose remain, but dropped in, it must be first separated from its adhesions and raised. If the nose be still whole, but curtailed and dropped in, it must not be removed, but, according to Dieffenbach, covered by planting upon it a flap of skin, for the reception of which, as well as when the whole nose is wanting, a strip of skin, a line and a half wide, must be cut out, and thus a sufficiently deep groove formed. Lastly, a broad transverse groove must be cut out to receive the *septum*; or the upper lip being drawn well from the upper jaw, and the scalpel thrust through where the lip is attached to the jaw, completely separates it to the breadth of an inch and more, according to the thickness of the *septum* (Zeis.) The bleeding must be stanched with cold water, and only when this is insufficient, by tying the vessels. The preliminary stitches may now be made at the points marked around the stump of the nose, and the threads held by an assistant; or they may be made afterwards, when the flap is turned down and properly applied.

2538. The separation of the frontal flap is now to be proceeded with. The convex scalpel being inserted rectangularly at the topmost point, divides, with a sharp, bold stroke, along the marked line, or at the edge of the sticking plaster, the skin of the forehead through its entire thickness, avoiding the bridge, which still remains on the root of the nose. The upper part of the flap is now grasped with hook forceps, and carefully dissected off from the *galea aponeurotica*, which is preferable to removing it with the *galea* itself, to render the flap as thick as possible, and the division is to be carried to the very extent of the line which marks the bridge of skin; or the one end of the cut, circumscribing the flap, is carried on till it reach that for its attachment. The bleeding from the wound in the forehead must be stanched with cold water or ligatures, and carefully covered with a piece of soft German tinder.

The continuance of one cut into the wound on the stump of the nose is advantageous, as then twisting round the flap is easier, and the swelling arising from this twist is much less, and more points of attachment for the transplanted flap can be obtained, because the suture may be continued along the bridge of skin.

Labat endeavours to prevent the narrowing of the nostrils, and the alteration of the nose dependent on the granulations developed within, by covering the inner surface with skin at the operations. For this purpose he bounds the frontal flap above with a curved cut, extending from the wing of the nose above the *septum*, and after separating, divides it by two vertical cuts into three pieces, of which the middle folded together lengthways forms the *septum*, and the two side pieces also folded in, and with a thread passed with a needle from without inwards, and from within outwards, and having its end knotted, are kept in this position, that the wings of the nose may be formed of a doubled skin. Blasius had previously operated in this way with success, and Dieffenbach, also, by forming an oval flap from the forehead, the lower end of which he twice cut into. This mode of practice is specially advantageous if the skin of the forehead be very thin, as the otherwise shrivelled end of the nose gains thickness, and the openings of the nostrils easily narrow.

2539. The flap of the skin from the forehead is now dropped down, and twisted half round on its axis, so that its epidermal side is outmost, and it is observed whether its edges can be applied to those of the nose-stump, or into the groove prepared for it, without any dragging. If the flap be tort, the bridge of skin must be loosened still more, and the side cuts lengthened some lines lower. If the flap fit at every part, as soon as the bleeding ceases, its attachment by the interrupted suture must be proceeded with. the threads previously introduced in the stump of the nose being passed through the corresponding edge of the flap, and finishing with that on the *septum*. After the wound has been cleansed of the blood that hangs about, the threads are tied in knots from above downwards, so as to produce the closest application of the edges, and when at any part these gape asunder, another stitch must be introduced.

Union with the interrupted suture is the most convenient, as the twisted suture with thin insect-pins, according to DIEFFENBACH's plan, is in many parts very difficult to apply, and in withdrawing them, the easy tearing asunder of the edges of the wound is to be feared. GRAEFE's ligature-stem, which after its application may be so separated on the face, and each part fixed with plaster, that no tension is produced, is useless, and not to be recommended. And equally so are his pieces of ivory placed beneath the ligatures (*a*).

2540. The wound in the forehead is now to be brought together, where the nature of the wound and the yielding of its edges permit, with insect-pins and the twisted suture, and the middle of the remaining open space covered with a piece of soft German tinder, and with lint and sticking plaster.

Advantageous as it is to draw the wound in the forehead together by uniting some of its points, for the purpuse of shortening the time of cure and lessening the scar, yet, however, drawing the wounded edges forcibly together should be cautioned against. Also, when the frontal wound is healed merely by suppuration, as proposed by GRAEFE, and properly brought together with sticking plaster, with good management there will not be any scar, as is commonly stated.

2541. Into the apertures of the attached nose, quills, covered with lint and oiled, should be introduced; or, according to ZEIS, tubes made of plates of caoutchouc, which have recently come into use. Plugs smeared with rose ointment (GRAEFE) inconvenience the patient, because they prevent the passage of the air through the nostrils. The patient should be kept in bed in rather a sitting posture, with his head sufficiently bowed forwards; he must be kept quiet, and his diet should be antiphlogistic.

When the nose first becomes discoloured and seems fallen together, it must not be considered a bad omen; turgor usually soon sets in, the nose swells, reddens, becomes shiny and moderately tense. If these symptoms become severe, if the nose be bluish and hot, it must be treated strictly antiphlogistically, cold applications are to be made to it, and general and local blood-letting by leeches or by scarification. If, as often happens under these circumstances, there be bleeding from the edges of the nasal apertures, it must be kept up for the due depletion of the flap. In one case I saw this bleeding continue twenty-four hours, and with the best result. Only when the bleeding is considerable, must it be stanched by the application of German tinder. It is more common that the nose is endangered by overloading than by want of blood; but if due *turgor* do not come on, if the flap remain cold and discoloured, light aromatic applications must be made. If gangrene ensue, it is either partial, and then in general attacks only a straw's breadth of the edges of the flap, or if union come to a stop, pus presses out along the whole cleft of the wound, and the entire flap dies.

Besides the above-mentioned causes, the occurrence of gangrene may depend on the tough, callous nature of the edges of the nose-stump, or

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(*a*) BECK; in Heidelb. klinisch. Annalen, vol. iii. part ii.—CHELIUS, Gelungener Fall einer Lippen und Nasenbildung an einem Subjecte; in same, vol. vi.—TEXTOR; in Neue Chiron, vol. i. part iii.

from constitutional dyscrasic symptoms, or from improper irritating treatment, whilst there is increased *turgor* of the flap; then the gangrene usually appears from the third to the fifth day after preceding symptoms of increased *turgor*. It is well worthy of notice, that the surface of the nose has frequently a gangrenous appearance, and after throwing off a superficial slough, good granulations appear, and the flap remains perfect. (WALTHER).

The best sign is when the united edges of the wound are covered with a crust of dried lymph, from whence speedy union may be safely concluded.

The removal of the stitches or of the pins should in general be effected on the third or fourth day, and the union is to be preserved by strips of court-plaster laid across. Other matters, as nervous symptoms, erysipelas, and the like, must be treated according to the ordinary rules.

2542. When the nose has completely united at all points and the lower part of the wound on the forehead has scarred, if the flap have been twisted round, a narrow bistoury must be passed under the fold of skin formed by the twist of the flap, which should be cut through obliquely upwards so that a small flap is formed; and this is to be applied to the raw made upper part of the stump of the nose, for which purpose a suture is only sometimes proper, but the application of sticking plaster is generally sufficient. If there still remain any puffiness of the frontal flap, it must be got rid of.

If the bridge of skin have been formed by continuing the cut into the wound on the nose-stump, and the bridge heal in, a myrtleleaf-shaped piece must be cut out of it, and the edges united with insect-pins and the twisted suture. But if there be too much skin on the back of the nose, it must be completely removed.

2543. For the purpose of perfecting the form of the nose after union is complete, various modes of after-operation may be requisite, which, however, dare only be first undertaken when the skin has recovered its natural condition. A puffy scar, when not expected gradually to diminish and disappear, should be cut out with two parallel cuts, and the edges of the wound closed with the twisted suture. Deep scars must also be cut out, and if the edges of the wound be also somewhat loose, a little more skin must be removed from the bottom than from the surface, and the wound brought together with the twisted suture. If the nose be very puffy and misshapen, an almond- or myrtle-shape piece should, according to DIEFFENBACH, be cut out, and the edge of the wound united vertically. If the tip of the nose project too little, a flap from the new nose should be made, according to DIEFFENBACH, by two slightly curved cuts meeting in an angle above, and diverging below towards the *septum*. If now the upper angle of the wound be united with a twisted suture, and thus the space for the inhealing of the flap be restricted, the flap must be compressed from side to side, and fixed by some retaining apparatus, so that the tip of the nose shall project.

For the proper formation of the nostrils GRAEFE recommends the introduction of tubes fastened with a peculiar apparatus, and afterwards furnished with superficial plates. An eductor which fits into this and draws it forwards, thereby shaping the tip of the nose, is fastened on a compressing instrument which can act on various parts of the nose and give it the proper form. This apparatus is to be worn the whole of the first winter, and only laid aside in the following summer, that the nose may be exposed to the hot rays of the sun!

2544. With the restoration of the whole nose must also be classed those cases in which there are only single defects, to wit, of the wings and sides of the nose, of the ridge and *septum*, which must be managed by transplanting the skin from the neighbouring parts.

2545. Attempts to supply *defects of the wings of the nose* from the skin of the cheek had no satisfactory result; hence DIEFFENBACH prefers the skin of the forehead. After paring the edges of the stump of the nose, a sufficient flap of skin is separated from the forehead, the side of the nose cleft, the flap twisted to that side, and fixed with twisted sutures. The neck of the flap is for a time healed into the cleft on the side of the nose; but after the scarring is complete, it is removed. The wound on the forehead is brought together with the twisted suture.

When only a narrow portion of the wing of the nose is deficient, DIEFFENBACH cuts off the edges, as in the operation for hare lip, and brings them together with insect-pins. If a large piece be wanting, he cuts out a corresponding portion from the healthy side so as to make both sides of the nose alike, and then fastens up both wounds. If the cleft be pretty broad and high, DIEFFENBACH lengthens the cut from the point of the triangle through the wing to the bridge of the nose, and cuts out a piece from it and the *septum*. If the wound heal by the first union, he cuts out a corresponding piece from the other side of the nose.

2546. If *the side edge be wanting as well as the wing of the nose*, a flap corresponding to its extent must be cut out of a piece of paper, and a like flap cut out of the skin of the forehead. Care must be taken that the part of the flap, which is to be put into the upper part of the defect, should correspond to it, but the lower part of the flap which corresponds to the opening of the nostril must be made rather broader, and so much longer, that its edge may be folded in, to prevent the contraction of its edge and the narrowing of the nasal aperture (*a*).

2547. If the *bridge of the nose have sunk in*, by the destruction of the bones, but the tip still stand up, a scalpel should be thrust between the eyebrows, and the nose cleft throughout its middle to the tip. The adhesions which draw down the sides of the nose to the skin of the cheek must then be divided, so that the sides can be drawn up. An oval piece of sticking plaster must be fitted between the edges of the wound to give the model of a good bridge. The plaster is then fixed on the lower part of the forehead, and cut round in such way that one cut shall pass into the cleft made in the nose, but the other only to the left eyebrow, and here a strip is left for nutrition. The flap is now separated, twisted round, fitted into the cleft, and fastened with the twisted suture. As this flap, after healing has a misshapen form, DIEFFENBACH has proposed overplanting, or underhealing the frontal flap; in doing this, the operation is at first performed precisely as in inhealing, and when this is done and the scarring complete, pieces of the transplanted skin must be cut out, and the edges of the wound brought together by the twisted suture. The excision must be repeated till the whole of the inserted piece of *corion* has been removed, and the edges of the original nose-stump united over the remaining thickened cellular tissue.

2548. The *deficient columna narium* may be variously replaced. If when the column be wanting, the nose itself be very large, so that by removal of a portion it will not be disfigured, and the upper lip from being too shallow or beset with scars, is unfit for making the reparation, then a piece four or five lines broad and about an inch long, must be cut out of the thickness of the nose, and with its neck attached to the tip, turned round, and fastened

(*a*) ZEIS, above cited, p. 516.

to the upper lip in a groove previously made there: the wound on the nose is to be united with the twisted suture.

In the so-called *bottle-nose*, or in that form in which the nose is turned up and the bridge resembles a saddle, the cuts should be made, according to DIEFFENBACH, as in the former case, only that both cuts should equally descend to the free edge of the wide nostril. The lower edge of this flap should be made raw, the upper and middle part separated from the underlying cellular tissue, so that its undermost part alone remains connected, and serves for nutrition. The flap thus separated, is usually so movable that it may be drawn down to the upper lip, where it must be fastened with the interrupted suture to the part made raw, and the cleft on the middle of the nose must be united with the twisted suture. If the flap cannot be brought sufficiently down to the lip, the cartilaginous part of the tip and of the column of the nose must be so far cut transversely till the lowest part of the flap can be united to the corresponding part of the upper lip. The upper part of the flap must be attached also on both sides with insect-pins to the tip of the nose. When it has perfectly healed, the tip of the nose must be kept down towards the upper lip with pieces of sticking plaster put across it, so that the new *septum* be not very much stretched. If the deficient column cannot be supplied by the preceding method, a corresponding piece must be formed by two cuts from the whole thickness of the upper lip, of which the red part has been cut off, the entire piece turned up, fixed to the tip of the nose, and the wound in the lip brought together with the twisted suture. This turning up of the flap by which its mucous surface becomes outermost is better than twisting the flap, which is always violent; and the mucous membrane soon assumes the appearance of the external skin (FRICKE, DIEFFENBACH, LISTON and others). If the condition of the upper lip do not admit the formation of a flap of its whole thickness, a corresponding strip of skin must be cut out of it in a horizontal or oblique direction, turned round and fixed into the nose. The wound in the lip must be united with the twisted suture.

[Sometimes by the retraction of the parts, after making the column from the lip, the lip and nose become approximated, and the movements of the former are impeded. This happened to DUPUYTREN, who did not choose to do anything more. GENSOUL of Lyons (*a*), however, corrected this inconvenience in the following way. He "plunged the point of a very sharp bistoury obliquely to the right of the base of the flap attached to the lip, and divided it in nearly its entire depth and height; then did the same on the left, and these two oblique incisions meeting at their summit in the thickness of the lips, the flap was detached. It represented the figure of a wedge; he removed it, and having thus reduced the wound of the lip to a simple incision, by this loss of substance, reunited it by means of a pin and waxed thread. The nose, which had been much pulled down, being no longer fixed, was elevated by the elasticity of its cartilage. The advantage thus gained has since continued.

In a case in which a large portion of both jaws were exposed by gangrene of the left cheek, and the teeth and alveolar processes were much thrown out during the healing process, GENSOUL (*b*) cut away all the attachments of the scar and integuments, chiselled off the projecting part of the jaws, dissected up about two inches of the skin of the upper part of the neck, and one inch of that of the cheek, and brought the edges together with sutures and adhesive straps. The deformity was thus removed, leaving a small salivary fistula which was easily covered.]

(*a*) Journal Clinique des Hôpitaux de Lyons, No. I.—Journal Hebdomadaire de Médecine, vol. vi. p. 442. 1830.

(*b*) Ibid., p. 442.

OF FORMING THE NOSE FROM THE SKIN OF THE ARM.

2549. The formation of the nose by a piece of detached skin, for which the skin on the inside of the arm immediately over the *m. biceps* is best suited, is for both patient and operator a very much more troublesome operation than the Indian rhinoplasty; it is more uncertain in its result, and better fitted for the reparation of a part than of the whole nose. The transplantation is performed either immediately after detaching the flap (GRAEFE's German method,) or after previous preparation of the part (TAGLIACOZZI's Italian method.)

2550. In the *German Mode of Rhinoplasty*, which can only be undertaken in persons who are very healthy, and whose skin is quite sound, the necessary bandages are to be applied nightly for some time, eight days, previous to the operation, so that the person may get accustomed to them; and every day, the part of the skin of the arm to be used in the reparation is to be rubbed with spirit, when the waistcoat must be drawn together, but the hood thrown back. The measurements for the flap of skin, and the markings on the nose-stump are to be made as described in the Indian method, excepting that the part of the flap corresponding to the *septum*, which runs downwards, should be about two-fifths narrower than the wings of the nose, and should be marked of such length, that the whole flap should be one-fourth longer than the paper model. The edges of the nose-stump are to be so refreshed that the side cuts meet above; the notch for the *septum* is not yet to be made. The threads for the stitches are to be introduced at the determined points. A piece of the skin of the arm is now to be separated, with as much cellular tissue as possible, on both sides and at the upper end, and the arm having been raised close to the face, the parts are brought together by drawing the threads through the points marked on the skin of the arm. Lint is to be put into the nostrils, and upon the under surface of the flap of skin and on the wound in the arm a pledget, spread with rose ointment, which must be fastened with strips of sticking plaster. The arm is now to be kept in the proper nearness to the face by the connecting bandages. The general and local treatment must be conducted according to the rules laid down for the Indian method, and more especially must the patient keep his head and arm perfectly still. As often as the lint is sopped with the pus and fluids it must be removed, and the nostrils cleansed by injecting lukewarm water. If union take place, the stitches may be removed, though not earlier than seventy-two hours. When the union has acquired sufficient firmness, the division of the skin from the arm must be made; and this is done, after removing the bandages, and whilst an assistant supports the arm, by making a transverse cut between the lower angles of the longitudinal cuts with a rather long, convex bistoury; after which the skin flap is kept in its proper place by the introduction of pledgets spread with zinc ointment and strips of plaster, and must be covered with a layer of aromatic cotton to protect it. After about fourteen days the formation of the nostrils and *septum* must be undertaken, for which purpose, with the aid of the model, the position and form of the nostrils and *septum* is to be marked with varnish, and cut out with a narrow scalpel and COOPER's scissors, and the *septum* fixed into the wound made for it with two stitches. In from three to five days, when the *septum* has healed, the stitches must be taken out, and the further treatment, in reference to dressing and improving the form of the nose, managed according to the Indian method.

Benedict (*a*) has specially endeavoured to further the preference of the German method by his successful practice, and has proposed an alteration of the binding apparatus, by which it is rendered easier to change the dressings; he puts plugs into the apertures of the nostrils.

According to Galenzowski, the *septum* should be formed immediately after the separation of the flap from the arm, and fixed at once.

2551. In the *Italian Method of Rhinoplasty*, the piece for the flap is marked upon the corresponding part of the arm, which, on account of its shrivelling up afterwards, should always be six inches long and four broad. Instead of the trellis forceps used by Tagliacozzi, it is better, according to Graefe, first to make the two side cuts with a scalpel, and then divide the skin from the underlying cellular tissue, with a very blunt director, a gum fleam, or even with the finger, from one side cut to the other. A piece of linen spread with rose ointment is then to be drawn by a thread fastened to its side, under the flap; the side cuts are covered with lint spread with rose ointment, with a compress, and the whole fastened with a circular bandage. This dressing is to be first removed after three or four days, but a fresh piece of linen is to be previously introduced beneath the flap, if suppuration be properly established. In this way, with proper modifications, according to the condition of the suppuration, and so on, the case is to be proceeded with, and then the division of the flap, at the upper end of the side cuts, must be made upon a director introduced for the purpose. The flap should not, according to Graefe, be turned back as recommended by Tagliacozzi, but merely supported by a wad of charpie and oiled pasteboard; and afterwards dressed with lead wash or decoction of elm bark. The flap always shrivels up, but gains in thickness proportionally; and towards the sixth or eighth week, sometimes still later, though according to Tagliacozzi, in a month, becomes completely fixed. The mode of fixing the flap, and the further treatment, corresponds with that of the German method.

OF RAISING A SUNKEN NOSE.

2552. When the bones and cartilages of the nose have been destroyed, and the soft parts remain, though sunken, according to Dieffenbach, the remains of the old nose must be dissected in several parts, drawn up, and fixed in such way that the nose is raised up. The head of the patient must be steadied by an assistant, a narrow pointed scalpel passed into the left nostril, and the soft parts divided with a stroke in the side of the ridge of the nose up to the nasal process of the frontal bone. The same is to be done on the right side, so that there is a strip of skin from the ridge and tip of the old nose remaining between the two side cuts, becoming narrower above, and connected with the skin of the forehead, and attached below by the shrivelled *septum* to the upper lip. If this be destroyed, the flap can be raised; if the *septum* be shortened, it may be easily lengthened by a cut on either side downwards through the upper lip. Some lines below the end of the first cut, the knife must be thrust, at the junction of the right nostril with the cheek, down to the bone, and carried through the whole of the soft parts obliquely down to the line where the floor of the nose terminates on the skin of the cheeks. The same cut is

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(*a*) Beitrage zu den Erfahrungen über die Rhinoplastik nach der deutschen Methode. Breslau, 1828; with four plates.

continued to the left side, and thus makes two semilunar cuts at the insertion of the wings of the nose, which pass round their lower part outwards and upwards into the former cut. These side flaps are now carefully divided from the bone, so that they may be raised and turned backwards. The skin of the cheek next the nose is then to be separated to the extent of three or four lines from the bone, so that it can be slipped towards the middle. The edges of the middle flap are now cut with scissors, in such way that its inner surface will be narrower than, but not separated from the epidermal side, for the purpose of giving the flap the form of a keystone of an arch. The edges of the wings of the nose are to be cut in the contrary direction, so that a strip as thick as a straw may be removed from the upper surface, leaving the inner surface untouched.

After carefully cleansing the wound from blood, the parts are brought together with twisted sutures, of which the lowest should be by the side of the tip of the nose. Around that part of the upper lip from which the *septum* has been taken, a ligature must be passed, and so placed behind it as to draw it and the tip of the nose forwards, and prevent its reunion in the old groove. The junction of the side edges of the nose with the skin of the cheeks is effected with four interrupted sutures. Lastly, two long pins are carried through the edge of the separated skin of the cheeks behind (on each side of) the nose, through strips of stiff leather, which are pressed together on the one side by the heads of the pins, and on the other, by twisting their points spirally with the forceps, by which the nose is permanently projected. The after-treatment is conducted according to the rules laid down for the Indian Rhinoplasty.

This exceedingly troublesome and very painful operation rarely answers expectation, as according to my own experience, although the nose remains for a time after the operation pretty well, yet subsequently, it again shrinks. For this reason, Dieffenbach thinks it preferable, in most cases of flattened nose, to insert a strip of skin, which may afterwards be partially removed (*a*).

[Liston's treatment of this deformity is much more simple. He observes:—"Sometimes the cartilaginous portions of the nose fall a prey to abscess and ulceration, while the integument remains intact, excepting the column, which usually shares the fate of the cartilages. The consequence is a sinking down into the nasal cavity. The depression may be obviated by simply raising the parts after dividing any adhesions that may have formed in their new situation. By stuffing the nose carefully and neatly, the integument is retained of a proper shape until the disposition to fall in is in part overcome, and firmness and stability obtained. Then a new *columna* is raised and fixed, and careful stuffing of the nostrils is continued until all has become consolidated." (p. 264.)

Fergusson's (*b*) method differs from Liston's, in not making use of stuffing and in supporting the cheeks. He "introduced a scalpel into the opening in the nose, and dissected the sunken *alæ* from their attachments underneath, then raised the cheeks for more than half an inch from the surface of each upper maxillary bone, and cut to such an extent as to allow, when the finger was introduced under the nose, to raise and put it into a shape somewhat like the original. He then passed two silver needles, armed with steel points, and provided with small round heads, from the left cheek to the right, under the nose, and through those parts which had been dissected from the bones. By means of two pieces of firm leather, two inches long by one-half broad, through which the pins were also passed, he was enabled on twisting the extremity of each pin

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(*a*) Dieffenbach, above cited.—Rust, Neue Methode, verstümmelte und durchbrochene Nasen auszubessern; in his Magazin, vol. ii. part iii.—Wattmann, Ueber verkrüppelte Nasen und deren Formverbesserung; in Beobachtungen und Abhandlungen von dem Dir. u. Prof. des Studiums der Heilkunde an der Universität zu Wien, vol. vi. p. 433.—Michaelis, Ueber die Herstellung der normalen Form eingefallener Nasen mittelst des Vorziehens ihres übrig gebliebenen Theiles; in von Graefe und von Walther's Journal, vol. xii. p. 291.

(*b*) Edinburgh Medical and Surgical Journal, vol. xliii. p. 363. 1835.

spirally, after having cut off the steel points, to bring the cheeks near to one another, and in this way to cause the nose to become prominent. On the eleventh day he withdrew the pins, and introduced two others at different points from those first used; and in eight days more, on these being removed, the nose stood quite prominent."]

2553. If the bridge of the nose drop in, as consequence of destruction of a part of the *septum*, but the bony frame still remain perfect, according to DIEFFENBACH, a wedge-shaped piece should be cut out of the previously long and down-hanging nose. The tip of the nose being stretched, the straight edge of a knife is placed upon the ridge of the nose below the nasal bone, and the nose is cut through at a stroke, with the blade turned a little upwards, to the skin of the cheek. A like cut is then made obliquely upwards beneath the depression, so that both cuts meet at an angle, and cut out a wedge-shaped piece. When the usual smart bleeding has ceased, and the secretion of lymph into the wound has begun, two interrupted sutures are passed with round needles through the *septum*, one end of each thread cut off, and the other carried to the nostril. The edges of the wounds on the sides and ridge of the nose are to be united by six or eight twisted sutures.

With a small, straight-pointed nose, which by cutting out a wedge-shaped piece, would be drawn too much upwards, on each side two semicircular cuts must be made, so that the one point of the oval turn to the ridge and the other to the base of the nose. The union of the *septum* and of the outer edges of the wound are made as in the former case. After the operation a little bump is formed on the ridge of the nose, which at a later period becomes level. In other cases the ridge of the nose may be preserved, and merely an oval piece cut out of both side walls, so that one point of the oval turn towards the cheek, and the other to the ridge of the nose. The union is managed as before.

Here also must be mentioned the inhealing of metallic frames and plates of gold or platina, for putting to rights sunken noses, as has been attempted by RUST, KLEIN, GALENZOWSKI, and TYRRELL. Although the inhealing readily take place, yet the plate must most commonly be removed afterwards.

[I recollect TYRRELL's operation with a silver frame, which consisted of a long narrow silver stem for the ridge, terminating below in three prongs, which were bent so as to support the column and wings of the nose, to which it at once gave an excellent form. Its subsequent removal, for what reason I do not recollect, was attended with much difficulty; and, if my memory be correct, the nose which had been made with a flap, dropped down and was not very ornamental.—J. F. S.]

2554. If the tip of the nose be turned too much downwards, as in double hare-lip and wolf's-jaw, and depend on a folding of the cartilaginous *septum*, the nose may, according to DIEFFENBACH, be raised by cutting through this fold. The skinny *septum* is to be taken hold of and drawn aside till the fold appears, which is then to be pierced with the point of a small scalpel, and cut through to the root of the bony *septum*. The tip of the nose immediately rises of itself, and still more if it be raised. Compression of the sides of the nose is to be made with leathern or leaden splints, through which long insect-pins are to be thrust across the nose, and pressed togther by rolling up their ends; or a saddle-shaped plate of lead is to be worn on the nose.

II.—OF THE MECHANICAL COMPENSATION FOR LOST PARTS.

2555. The compensation for lost parts by mechanical contrivances is either merely with the object of removing or diminishing deformity, or for restoring the functions of lost parts; the former is the object of artificial noses and eyes, the latter of artificial legs and the like.

A.—OF ARTIFICIAL LEGS.

2556. The oldest and most simple contrivance for the purpose, after the loss of the thigh or leg, of rendering the mutilated person capable of walking without crutches, is the *wooden leg*, (*die Stelzen*, Germ.; *jambe de bois*, Fr.,) which, though it do not hide the deformity, still, especially with some practice by the cripple, answers its object tolerably well. For the purpose of not merely supplying the lost function of walking, but also of giving, as far as possible, the form of the lost limb, a multitude of contrivances have been proposed, from PARÉ up to the present time.

2557. PARÉ (*a*) gave an engraving of a machine for the amputated thigh which was furnished with a knee-joint, and with joints in the fore part of the *tarsus*, and with an elastic spring. RAVATON (*b*) invented artificial legs for those who had lost their leg immediately above the ankle. WHITE (*c*) describes artificial tin legs covered with thin leather. ADDISON (*d*) invented an instrument with motion at the knee- and ankle-joints. WILSON (*e*) formed legs of stiff leather. In Germany BRÜNNINGHAUSEN (*f*) made known an artificial foot, which was far more perfect than the old ones, and gave pattern to those of STAH (*g*), BERRENS (*h*), HEINE (*i*), GRAEFE (*k*), RÜHL (*l*), PALM (*m*), DORNBLUTH (*n*), and SCHURUCHAT, for the thigh, and WALS (*o*), MILES, SERRE, and others, for the leg.

2558. In making choice among the different kinds of artificial legs, the following points are to be attended to:—Besides the correspondence of the artificial with the whole leg as to form, for the purpose of removing the deformity, it must be made as light as possible, but proportionally strong; it must allow the natural movements; and afford a convenient and safe rest for the stump which it surrounds, avoiding, however, all painful pressure on it, and specially on the amputated surface. Simplicity of construction and lowness of price are, at least for the greater number of maimed persons, important advantages. Of all the artificial legs proposed, those which best answer these requirements, according to my experience, are RUHL's for the leg and STARK's for the thigh.

2559. RUHL's leg has the peculiarity of well-stretched Russia leather, two inches broad around the stump, to which two strong brass hooks are attached; with this the stump received into the socket of the leg is sus-

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(*a*) Œuvres, p. 904. Paris, 1798.

(*b*) Chirurgie d'Armée, &c. Paris, 1768. 8vo.

(*c*) BELL, B., System of Surgery, vol. vi. p. 512.

(*d*) BROMFIELD, WILLIAM, Chirurgical Observations and Cases. 2 vols. 8vo. London, 1773.

(*e*) BELL, B., above cited.

(*f*) RICHTER's Chirurgische Bibliothek, vol. xv. p. 568, fig. i.-iv.

(*g*) Anweisung zum verbesserten chirurg. Verbande, p. 498, pl. xxiv. fig. 227, 228. Berlin, 1802.

(*h*) LANGENBECK's Bibliothek der Chirurgie, vol. iv. p. 173, pl. i. fig. i.-iv., pl. ii fig. i. ii.

(*i*) Beschreibung eines neuen künstlichen Füsses, für den Ober- und Unterschenkel. Würzburg, 1811.

(*k*) Normen für die Ablösung grösserer Gliedmassen, p. 147. Berlin, 1811.

(*l*) Ueber die Ersetzungs Chirurgie im Allgemeinen, nebst Abbildung und Beschreibung eines künstlichen Unterschenkels; in HUFELAND's Journal, vol. xl. part iv. p. 1. fig. i-viii. 1818.

(*m*) Dissert. (Præs. AUTENRIETH) de pedibus artificialibus. Tübing., 1818.

(*n*) Ueber den Mechanischen Wiederersatz der verlorenen unteren Gliedmaasen durch eigene Apparate. Rostock 1831; with two plates.

(*o*) RUST's Magazin, vol. lxii. part iii.—ROSSWINKLER, A., Ueber künstliche Füsse. Wien, 1836. fol.—FRORIEP's Chirurgische Kupfertafeln, pl. ccccli.

pended, and so fastened that the amputated surface is not subject to any pressure. The leg is connected by a joint to the foot-piece, and this in like manner to the toe-piece. At the upper part of the leg, on both sides, are two wings fixed with hinges, which are applied on both sides of the thigh, and drawn to with a strap. The whole leg is made of lime-wood, properly hollowed, having been previously sawn through for that purpose, afterwards glued up, surrounded with a bandage dipped in glue, and afterwards lacquered.

2560. Stark's thigh consists of a thigh-piece, made of copper or tin, for the reception of the stump; of a knee-piece and leg, composed of soft but tough wood, and connected by a hinge; and lastly, of a foot- and toe-pieces. The fastening of this artificial limb is by means of an iron rod passing up from the thigh-piece to the hip-bone, by which it is attached with a strap around the *pelvis*. Over both shoulders strong straps, like breeches braces descend, and are fastened behind and before to knobs with elastic springs. The weight of the whole body rests on the padded edge of the thigh-piece, so that the end of the stump lies in the cavity of the thigh-piece, softly, upon an elastic leather pad.

2561. When, after amputation of the leg, the stump becomes permanently bent, or where it has been so bent by *anchylosis* of the knee-joint, then, only, a *wooden leg* can be used. This consists of a lower portion turned cylindrically, upon which an upper piece hollowed in an oval or semicircular shape rests, from which two splints an inch and a half wide rise up on the thigh, the outer to the hip-joint, and the inner to the middle of the thigh. These splints are fastened by straps to the thigh, and from the upper end of the outer another strap passes round the *pelvis*. I have in many instances extended the long splint only to the middle of the thigh, making it, however, so elastic, that by means of straps it may be brought quite close to the thigh, by which the leg is rendered much lighter and more convenient (*a*).

Rühl (*b*) has made a wooden leg, in which with motion at the knee-joint, the stump is fastened in the same way as with artificial legs, and the maimed person is capable of moving the knee-joint.

2562. For the thigh, that wooden leg is best in which Stark's socket for the stump of the thigh is fixed upon the cylindrical lower piece, and its firm application is in this way as in an artificial leg effected.

2563. The wooden leg has always the advantage of simplicity, less price, firmer application, and greater lightness. In the leg, the backward bent stump, if not too long, rests easily, hidden with a rather wide stocking. For poor persons, especially of the labouring class, a wooden leg always answers best. I have often seen rich persons, after trying various kinds of artificial legs, given them up for a mere wooden leg.

2564. After amputation between the *astragalus* and *os calcis* and navicular and cuneiform bones, the supply of the mutilation is readiest: as in most artificial feet, two foot pieces, properly hollowed and padded behind, so that the scar of the stump cannot be pressed, are made use of. The whole is put into a boot or leathern stocking, which is drawn together and fixed to the knee (*c*). When in this case the calf has considerably shrunk above, it is necessary that the footpiece should be so fastened to the heel, that in walking the heel should be a little pulled down.

(*a*) Brünninghausen's Wooden Leg, above cited, pl. iii.

(*b*) Above cited, part v. p. 108, fig i.–iv.

(*c*) Graefe, above cited, p. 155.

B.—OF ARTIFICIAL HANDS.

2565. In **Pliny** (*a*) is found an example of the replacement of a lost hand by an iron one. The artificial hand of **Götz von Berlichingen** is well known, and its mechanism has been described and engraved by **von Mecheln** (*b*). **Paré** (*c*) has given plates of artificial hands made of iron and boiled leather. **Wilson** (*d*) also manufactured them from leather. **Ballif** (*e*) of Berlin devised a contrivance more simple than **von Berlichingen's**, by means of which without the assistance of the other hand, flexion and extension could be performed at will, so that objects could be held firmly, and even a pen taken up and written with. Bending the fingers is effected with elastic springs, and straightening with cat gut, by bending and straightening the arm. For the application of such artificial hands, it is always necessary that there should be a sufficient stump of the fore-arm.

C.—OF ARTIFICIAL UPPER-ARMS.

2566. When sufficient stump is left after amputation, **Graefe** (*f*) thinks that it may perhaps be supplied, as well as in lost fore-arm, by an artificial hand, which must also have an artificial elbow-joint. The upper-arm must be surrounded with a sheath, from whence spiral springs pass to the fore-arm to effect the bending of the elbow-joint. Catguts fixed upon the opposite side, pass from the upper and hinder edge of the fore-arm to the armpit pieces of the chest-strap. If the arm, by bending the stump, be brought towards the chest, the fingers also by means of the springs, remain so. If the stump be carried away from the chest by means of the stretching of the catguts, the elbow-joint, and also the fingers, are straightened.

D.—OF ARTIFICIAL NOSES AND EARS.

2567. If the organic reparation of the nose be impossible, or be not effected, there remains only its replacement by one made of silver plate, of lime wood, *papier maché*, and the like, to hide the deformity. It is evident that such nose should be made to correspond as well as possible to the form of the face, and should be coloured externally to match. The fixing of this kind of nose, if only a small part of the original one be lost, is effected by smearing sticking plaster on its inner surface, or by springs in the nostrils, or by little bandages drawn through the nostrils into the mouth, and attached to the teeth, or what is best by a spring passing from the root of the nose over the temples to the back of the head. If the mutilated person wear spectacles with his artificial nose, the deception is very complete (*g*).

2568. Artificial ears are best made of silver, and fastened by a tube passing into the ear-passage, and a spring passing round the head.

(*a*) Historia Naturalis, lib. vii. cap. xxix.

(*b*) Die eiserne Hand des tapfern Ritters **Götz von Berlichingen**, u. s. w., beschreiben und abgebildet von **Ch. v. Mecheln**. Berlin, 1814.

(*c*) Œuvres, pp. 902, 903.

(*d*) **Bell, Benj.**, above cited, vol vi. p. 513.

(*e*) **Graefe**, above cited, p. 156–164, pl. vi. fig. i. ii.—**Geissler**, Beschreibung und Abbildung künstlicher Hände und Arme, nebst einer Vorrede von **Joerg**. Leipzig, 1817.

(*f*) Above cited, p. 164.

(*g*) **Klein**; in Heidelberg. klinisch Annalen, vol. ii. p. 103.

E.—OF THE SUPPLY OF LOST PORTIONS OF THE HARD PALATE.

5269. Openings in the hard palate are either vices of the first formation, as in wolf's jaw, or they are consequence of destroying ulcerations, specially those from *syphilis.* A piece of sponge, corresponding to the opening in the palate, attached to a silver plate, fills up the space, and thus the loss of speech and difficulty of eating and drinking are got rid of. Such instruments are called *obturators;* and it must be remarked, that there should not be too great hurry in having recourse to them, as both congenital clefts of the hard palate, as well as those produced by ulceration frequently contract and close of themselves, which process is prevented by the introduction of a foreign body. The obturator must be occasionally removed, cleansed, and replaced with another.

F.—OF REPLACEMENT OF THE TEETH.

2570. It has been already remarked (*par.* 896) that a tooth which has been drawn, if it be at once replaced in its socket, and the jaw kept quiet, most commonly becomes fixed, hence in former time arose the objectionable and inhuman practice of transplanting teeth.

2571. For the supply of lost teeth, others taken from the dead body, and properly cleaned, are used; these are inserted into the gaps of the teeth which have been drawn, and are fixed with silken or golden thread, to the neighbouring teeth. Or artificial teeth are manufactured from hippopotamus' teeth, from ivory or bone, and from enamel. If the tooth-socket be already closed, or very much narrowed, the crown only of an artificial tooth can be fixed upon the gum, and fastened to the neighbouring teeth. When the crown of a tooth is bad, but its root still remains firm, the crown must be filed off and another attached on the remaining root by means of a stem; or an artificial tooth may be fastened with springs to the neighbouring teeth.

SEVENTH DIVISION.

SUPERFLUITY OF ORGANIC PARTS.

2572. To this division belong few subjects, to wit, *first*, supernumerary fingers and toes; *secondly*, supernumerary teeth; and, *thirdly*, doubled teeth.

I.—OF SUPERNUMERARY FINGERS AND TOES.

2573. *Supernumerary Fingers* occur under two different forms. The supernumerary finger is either articulated with the metacarpal bone of the thumb, of the fore, or of the little finger; it resembles the other fingers in form, but is not provided with proper motive organs; and by its growth interferes with the motions of the neighbouring fingers. Or, it is not merely a supernumerary finger, but there is also a supernumerary metacarpal bone, and the finger has its perfect organization and mobility. The same applies to supernumerary toes.

2574. In the first case the removal of the supernumerary finger by disjointing it from its connexion with the metacarpal bone is indicated. In the second, disjointing the finger is of no use as regards the deformity; the metacarpal bone must also be removed. Such finger may be useful by its free motion and perfect organization.

II.—OF SUPERNUMERARY TEETH.

2575. Two conditions are observed with respect to these. Either a milk-tooth remains firm, and that which should have its place grows in some other direction, and penetrates through either the outer or inner surface of the alveolar process; or, in consequence of disproportion between the extension of the alveolar process and the breadth of the teeth, single teeth project, either obliquely or thrust through the fore or hind surface of the alveolar process. In the former case the unnatural direction of the second tooth does not seem to depend always upon the obstruction of the milk-tooth, as it is often observed when the milk-teeth loosen.

2576. Teeth standing irregularly, cause, in their further growth, considerable deformity, thrust out the lips, or irritate the tongue, and produce ulceration. It is usually advised to draw those milk-teeth which prevent the proper development of the second teeth and to bring the latter into their place by pressure. But that this should succeed, the partition which separates the milk-tooth from the other must not be very thick, the unnatural direction not very great, and the breadth of the second tooth not excessive in proportion to that of the first. If this be the case, and the first tooth be quite firm, it is better to pull out the wrong standing tooth, and to retain the milk-tooth.

2577. When the teeth stand obliquely from want of space in the alveolar process, it is necessary to draw the oblique teeth, in which case, if this be done early, the other teeth usually take a proper direction, and fill up the socket of the tooth that has been drawn.

III.—OF DOUBLE NOSE.

2578. Cases are mentioned as examples of double nose, in which tumours developed from the root of the nose, have the form of a second nose; or where the nose has been cleft in the middle. The former is either congenital or arising afterwards. Stout persons who live very well and drink much spirits are not very unfrequently subject to such swelling and degeneration of the nose, which often acquires so great a size that the enlarged nose overhangs the mouth and covers it (1). The single remedy here consists in the removal of the swelling by tying, or by the knife, which is best. The cut must be made according to the condition of the swelling. The bleeding may be very considerable, and the actual cautery may be necessary to stanch it. In cleft nose, the parts should be attempted to be brought together with sutures and sticking plaster, after previously paring the edges.

[(1) Hey (*a*) has given an account of a case of this kind, in which "the tumour extended to the lower part of the under lip; and compressed the patient's mouth and nostrils so much when he laid down to sleep, that he was obliged to keep a tin tube within one of his nostrils that he might be enabled to breathe. He also generally wore this tube in the day time, as the pressure which his mouth and nostrils suffered at all times from the bulk of his nose, rendered breathing without this instrument somewhat troublesome. * * * The disease appeared to Hey, to be nothing more than an enlargement of the common integuments of the nose. For though the latter were buried in the large mass of morbid integuments, yet when the tumour was supported he could distinctly trace with his finger the border of the cartilages."

Dalrymple (*b*) observes:—"This disease cannot be called simple hypertrophy, since this tissue has lost its natural pliancy and natural colour; but rather approaches to a state of *elephantiasis*, in which the cellularity is partially destroyed, and a fibro-cellular structure substituted. The mass presents externally a nodulated surface of a purple, or deep-red colour, traversed by numerous minute and tortuous vessels. The larger separated portions are frequently divided from each other by deep fissures, occupying in many cases the convexities of the *alæ* and extremity of the nose. Where the disease has been of long standing, the altered state of skin advances as high as the junction of the frontal with the nasal integuments, seldom encroaching much on the palpebral furrows laterally, but accompanied in the majority of instances by a wattled state of the skin of the cheek, corresponding in colour and general appearance with the tumour of the nose. The sebacious follicles are greatly enlarged, and their secretion is not only increased in quantity, but unless extreme cleanliness is attended to, it is offensive in smell and excoriates the surrounding skin." (p. 396.)]

Upon this subject may be further consulted—

Bartholin, Thomas, Historia Anatom., cent. i. hist. xxv.

Borel, Historia et Observationes Medico-Physicæ, cent. iii. obs. lxiii.

Bidault de Villiers; in Journal Complémentaire du Dictionnaire des Sciences Médicales, cah. xxxiii. p. 183.

Klein, Ausrottung einer ungewöhnlich grossen Nase; in Harless rheinischen Jahrbüchern der Medicin und Chirurgie, vol. v. part i.

(*a*) Practical Observations on Surgery, illustrated by Cases, p. 355. London, 1810. 8vo. Second Edition.

(*b*) On the Removal of Morbid Enlargement of the Integuments of the Nose; in Medical Quarterly Review, vol. i. p. 395. 1834.

EIGHTH DIVISION.

I.—OF THE ELEMENTARY PROCEEDINGS OF SURGICAL OPERATIONS.

2579. There is scarcely a Surgical Operation which can be fully perfected on a diseased body by one single, simple act. All rather consist of several manœuvres following, according to determined rules, and distinguished by the name of *Steps of the Operation* (*Operationsacte*, Germ.) One of these is the special object of the operation, and the others must necessarily precede or follow, to effect this object, and bring about the restoration of the patient. The object of the operation is always the same, but the manner and way of attaining it may be very different, and this difference may consist either in the difference of the several steps of the operation, or of the entire way by which the attainment of the object of the proposed operation may be effected. Hence arises the distinction between *Operative proceedings* and *Methods of Operating.*

2580. The *Method of Operating* is the compass of the regulated modes of proceeding, by which the object of an operation in any peculiar way is attained. In the various methods of operating, therefore, not merely are different parts cut through and in very different directions, but the practice of the methods of operating is so peculiar, that the one method does not exclude the other.

2581. Upon the choice of the method of operating depends for the most part the successful or unsuccessful result of the operation, just as upon the choice of the operative proceedings rests the facility of its execution. The choice of the mode of proceeding is therefore of little consequence, and depends commonly upon the operator himself. Hence also, the variety of opinions as to the preference of the mode of proceeding in general is greater than upon that of the method.

2582. In deciding upon the preference of the various methods of operation the following circumstances must be attended to. *First.* The least important organs must be injured, consequently the loss or destruction of organic parts caused by the operation, the pain, and the traumatic reaction depending thereon is least. *Second.* The better method must always be most fitting for the greater number of cases. *Third.* This must consist in the manœuvres, which do not make the operator dependent on accidental circumstances, but which rest completely on the will of the operator. Hereon and upon the nature of the parts to be wounded, are founded safety and facility in the execution of the method of operating. *Fourth.* The quickest cure which can be effected by the operation.

2583. Many operations are subject to certain and general rules, and but few cases require any variation in the way of their execution; to these belong, for instance, all amputations, the operation for the stone, laying bare arteries, and so on. Such operations may therefore be perfectly learnt by due practice upon the dead body. There are, however, on the contrary, other operations, and their number is the more considerable, which cannot be subjected to such definite rules, and of which the conduct must necessarily rest on the special difference of the case, and of the existing circumstances. These operations are the most difficult and require the closest knowledge of pathology, in order to be at the moment in a condition properly to comprehend and decide on the circumstances which present. Here belong, for instance, the operation for strangulated rupture, disjointing, cutting off the ends of bones, removal of tumours which are of considerable size, and seated in the neighbourhood of parts that dare not be wounded without the greatest danger to the patient. The difficulty of the operation in other respects depends on many particular circumstances, and is not always connected with one and the same act of the operation.

2584. Operations are specially called for, when the cure of the case cannot be effected by any other mode of treatment. But as whatever acts upon the material side of the constitution also affects the dynamic side and influences the reaction, and as the disease, which is hoped to be removed by the operation, is in many cases, merely the result of general persistent causes, hence must be borne in mind the various circumstances in reference to the successful result of the operation, which depend on the method of operation, the circumstances affecting the operation which relate to the condition of the patient, to the external circumstances under which the operation has been determined, and to the possibility of good previous and after treatment:

2585. That the operation should have the probability of a successful result, the following circumstances must be attended to:

First. The disease to be removed by the operation, must not be so connected with any general ailment, that may act on it as a cause to keep it up continually. In such case the operation would remove merely the product of the general disease, not the producing and sustaining cause. But not unfrequently a general disease terminates in a local disease, and the operation then has the happiest result, because it gets rid of the *residuum morbi.* In these cases a careful discrimination is necessary in order to determine which of the general symptoms are to be ascribed to the reaction of the local disease, or to a persistent general cause.

Second. The patient's weakness must not be great, nor the sensibility so excessive that the effect upon life resulting from the operation should bring it into very great danger.

Third. The local disease, to be removed by operation, must not by its long continuance or other circumstances, be so related to the constitution, that it have acquired the rank of a secreting organ, or have removed any previously existing disease, or have checked it in its earlier development.

Although the above circumstances generally contraindicate an operation, there may be still some cases where in spite of the decided prospect that no cure can be effected by operation, yet it may be employed as a palliative, if it be possible thereby to mitigate the sufferings of the patient, and lengthen his existence.

2586. In regard to the patient's condition it must be observed, that operations on persons who can bear pain quietly and patiently, are less dangerous than in those who are much excited by the least pain. Those patients who have suffered severely for a long while, have become accustomed to pain and are enfeebled, generally bear operations best, which depends partly on the moral influence of their earnest desire for the operation, and partly on the less degree of traumatic reaction. Persons of sanguineous temperament who seem to superabound with health, are unfavourable subjects for important operations. In like manner also, very stout persons of tall and strong make. Among nervous subjects a distinction must be made between those who are very sensitive and excitable, and those who on the slightest cause drop into moral despondency and nervous stupidity. The former are much affected by the pain of an operation, but on account of their easy excitability, they quickly again perk up, and are influenced by encouragement and comforting hopes, so that their spirit is again aroused; but such is not the case with the latter, who with dull despondency and nervous stupidity allow every thing to affect them, and without a murmur give themselves up. Young persons bear operations better than old ones; but even much advanced age does not contraindicate them; operations oftentimes do so much the better on account of the less degree of traumatic reaction. In gouty subjects operations are always dangerous; preparatory treatment, especially purging, is necessary in such cases. It must be noted especially in scrofulous subjects, whether there be not any particular organ as the lungs for example affected with that disease. Not unfrequently after the removal of a diseased part, scrofula breaks forth in the internal organs (*a*).

2587. From the circumstances already referred to, it may be for the most part ascertained under what circumstances it is necessary to prepare a patient specially for an operation, as according to his different condition such remedies must be previously employed, as either counteract the general disease, raise the patient's powers, or lower the increased sensibility, or by artificial evacuations, by issues and the like, render the result of the operation more safe. Very robust, full-blooded persons should for some time previously be put on spare diet; and bloodletting had recourse to if the general condition should seem to require it.

2588. The practitioner must determine, according to the patient's character, whether he may venture to make him acquainted with the more immediate circumstances of the operation, or conceal them from him. With sensitive persons he must go very cautiously to work; a kind and sympathizing carriage and encouragement, are often exceedingly advantageous. Great sensibility must be somewhat repressed by opiates, and in such persons small doses of opium before and early after the operation are required.

[As a general rule, the administration of opium or any other sedative, either before or after an operation should be carefully avoided, as it is difficult and often impossible to distinguish between the effects of the medicine and the symptoms springing out of constitutional excitement. Persons who have been long in the habit of taking opium to alleviate their pain, should not be deprived of it either before or after the operation, but great care should be taken to watch the period when it can be diminished, or completely withdrawn without disadvantage to the patient; and beyond all doubt this may frequently be done greatly to his benefit much more speedily than is in general believed. Many persons who have for a length of time suffered the excruciating tortures of ulceration of the cartilages of a joint, and not known an hour's rest for weeks, will enjoy quiet tranquil sleep the first night after the removal of the limb, without any other opiate than relief from the horrible pain that they had previously suffered, and will need no sedative during the whole course of their cure. The same also happens frequently with hectic cases after compound fracture. I have witnessed this state of things so frequently, that even if opiates have been previously taken, I endeavour to do without them; and

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(*a*) Wardrop, Lectures on Surgery; in Lancet. 1832-33; vol. ii. p. 517.

if towards night the patient drop off to sleep, none is given; but if he be restless and uneasy, opium must be given, and in such dose as shall ensure sleep, and if one be insufficient, a second should be given a few hours after, which is usually effective. Also if, on the evening after the operation, the patient should be restless or even only wakeful, although he have not been accustomed to opium, it should not be spared, as it is of the utmost importance to his well-doing that he should get sleep for the first few nights after the infliction of so severe an injury as an amputation. As to the sedative to be employed, opium is, I am sure, the most effective; in ordinary cases, its tincture, from thirty to forty drops at a dose, as may be, is sufficient; but sometimes, especially to free livers and sottish persons, it will be advantageous to give it in form of muriate of morphia, a third or half a grain at a dose, and such persons not unfrequently require it twice or three times a day during the whole course of their cure. Care, however, must be taken that the bowels should not be blocked up and loaded, as not unfrequently happens, and is best corrected by a dose of three or four grains of calomel, which in general answers sufficiently, without disturbing the alimentary canal, and exciting *diarrhœa*, as other purgative remedies too frequently do.

Another very important point in the treatment of operations, is the use of porter, wine, or spirituous liquors; even where the patient has been prudent and temperate, it is occasionally necessary that one or other of these should be given soon after an operation. But for persons who have been accustomed to take large quantities of porter or spirits, or both, and who, in consequence of severe accidents, are subjected to the amputation of a limb, or who have severe lacerations, which, however, do not require operation, it is absolutely necessary for their safety that the stimulant should not only be not entirely withdrawn, but even somewhat very near the quantity they have been accustomed to, must be allowed, or they either sink at once, are attacked with erysipelas. or are violently affected with *delirium tremens*, in which condition they speedily die. The quantity taken may often seem enormous under the circumstances; three or four glasses of gin or brandy, and as much or more wine, and sometimes porter besides, in the course of the twenty-four hours, is by no means an unfrequent allowance; and I have just the recollection of one of the younger CLINE's patients, a porter at the Royal Exchange, who required a pint of brandy daily after having suffered amputation of his leg for an accident. This man was saved by this treatment, and lived many years after, doubtless following the same free course of living which had required treatment, at that period thought exceedingly bold and almost marvellous in its result, although at present every day's practice and no wonder at all.—J. F. S.]

2589. In regard to the time of year when an operation should be undertaken, there is no longer any restriction, as was formerly the case with many operations. If spring have any preference over other seasons, it depends only on the steadiness of the weather. In other respects, if the circumstances of the case allow the operation to be deferred, in those operations, which, on account of their precision require bright light for their performance, and in persons who are subject to rheumatic and gouty affections, and are very sensible to changes of temperature, a bright day, and a season when steady weather may be expected, should be preferred. The time of very oppressive heat should be, if possible, avoided.

2590. In order to lessen the pain in operations, besides moderate doses of opium previous to the operation, it has also been advised to warm the instruments (*a*). WARDROP (*b*) has even proposed bleeding the patient to faintness previous to any important operation, and during the swoon to perform the operation ? !

[It is scarcely possible to imagine any one could have made so precious a proposition as that last referred to, unless the operator's object were to finish his patient. Another more recent foolery, with the same intent, is mesmerism, which, however, does not endanger the patient as WARDROP's proposal most certainly would.—J. F. S.]

2591. Among the most serious occurrences during an operation, besides severe bleeding, the following must be noticed:—

(*a*) FAUST und HEINOLD, Ueber die Anwendung und den Nutzen des Oels und der Wärme bei chirurgischen Operationen. Leipzig, 1806.

(*b*) Lancet, just quoted, p. 597.

First. Faintings and convulsions, which depend either on loss of blood, on want of blood in the brain from irregularity of the circulation, or from reflected activity of the spinal marrow, consequent on the severity of the pain. In all these cases the operation must be suspended, the patient placed in the horizontal posture, and roused by sprinkling the face with cold water, by scents, especially liquor of caustic ammonia, or naphtha, and according to circumstances, reviving remedies, as Hoffman's spirit of æther, wine, brandy, and the like, or some laudanum should be given.

Second. Sudden death, which may indeed be the result of very severe pain, or of loss of blood, and especially of the entrance of air into the veins. This last accident is more frequent, and more especially occurs when large veins, particularly those of the neck and armpit, are much pulled and dragged before being completely cut through. There is then heard at the moment the vein is cut through, a whizzing as on opening the air-tube, (*gluck-gluck geräusch*,) and immediately after, shivering, swooning, convulsions and death. The cause of the sudden death is the entrance of the air into the right side of the heart, by which its movements are suddenly stopped. The wounded vein must be directly pressed with the finger, and according to Amussat, the chest and belly quickly and forcibly compressed during expiration, and at every interval of such compression, the finger applied to the opening of the vein, and then the vein tied or twisted. Others have recommended bloodletting by opening the temporal artery, sprinkling with cold water, applications of ammonia and camphor to the nostrils, and pressure on the abdominal *aorta* and both axillary arteries, as well as drawing out the air which has entered the vein through a pipe with the mouth, or by means of a syringe and flexible catheter (Magendie.) In but few instances has the patient been recovered. It must not, however, be forgotten that many cases which have been ascribed to the entrance of air into the veins, are very problematical, and that death must be attributed to other causes.

Bichat ascribed death from the entrance of air into the veins, to its effect upon the brain; Nisten and Magendie to the extension of the heart; and Piedagnel (*a*) to emphysema of the lungs.

Amussat (*b*) attempted to restore several animals destroyed by the entrance of air into the veins, as already described. J. Warren (*c*) relates two cases, in the first of which, the patient was restored by bleeding from the temporal artery. Mussey (*d*) brought the patient to himself by the application of ammonia and camphor to the nostrils. Mercier (*e*), who attributes death from admission of air into a vein to the same cause which produces *syncope*, namely, the deficient supply of blood to the brain, recommends, that the small quantity of blood which—in spite of the obstacle offered by the admitted air to the transmission of the blood from the right to the left side of the heart and thence to the body—is, nevertheless, transmitted into the arterial system, should be directed towards the brain, and this by compression of the abdominal *aorta*, and of the two axillary arteries.

[Bransby Cooper (*f*) relates a case in which this alarming *syncope* occurred, after an amputation at the shoulder-joint, and whilst he was removing a small gland. Whilst recovering, the patient "uttered a continual whining cry, and maintained a constant motion of alternate flexion and extension of the right leg, whilst the left remained perfectly quiet." This movement continued for about nine days and then ceased.

(*a*) Magendie, Journal de Physiologie, vol. ix. p. 60. 1829.

(*b*) Mém. de l'Acad. Roy. de Médecine, vol. v. p. 82.

(*c*) American Journal of Medical Science.

(*d*) Schmidt's Jahrbücher. No. 9; p. 332. 1839.

(*e*) Revue Médicale, vol. iii. p. 294. 1837.—Amussat, Recherches sur l'Introduction accidentelle de l'Air dans les Veines. Paris, 1839.—Cormack, F. C., Dissertation on the presence of Air in the Organs of Circulation. Edinburgh, 1837 —von Wattmann, Sicheres Heilverfahren bei dem schnell gefährliches Lufteintritt in die Venen und dessen gerichtsärztliche Wichtigkeit. Wien, 1843.

(*f*) Med.-Chir. Transactions, vol. xxvii. p. 41. 1844.

2592. All kinds of operations, according to their nature, must be referred to the following principal acts, which, at the same time, must be considered as the elements of every operation, and of which every single act consists :— They are, *first*, Division ; *second*, Apposition ; *third*, Dilatation.

A.—OF THE DIVISION OF ORGANIZED PARTS.

2593. The division of the connexion of organized parts, is that one of the elementary acts of an operation most frequently brought into use, and in most operations constitutes their principal circumstance.

2594. The division of organic parts may be effected by *mechanical* or *chemical* means ; though the latter is less employed in reference to division than to other objects, on which account division by mechanical means will now alone be considered.

2595. The parts of our body may be divided—

First, By a cut or incision.
Second, By a stab or penetration.
Third, By tearing asunder.
Fourth, By tying or ligature.

2596. All instruments employed for the *division of soft parts by cutting* must be placed in two classes ; to the former belong those which have a single cutting edge, *knives*, *bistouries*, and *scalpels* ; to the latter, those consisting of two cutting edges, connected crosswise in their middle, and terminating in handles ; such are *scissors*.

2597. Knives are distinguished from each other, to wit, *by the fixing of the blade to its handle*, and *by the form of the blade itself*.

2598. The blade is either attached firmly to the handle, as a *scalpel*, or it drops into the scales of the handle and can be opened, as a *bistoury*. In bistouries the connexion of the blade is either such, that when opened, the blade is not fixed steady, but only cannot fall back, or the open blade may be fixed firmly. The mechanism for this purpose consists either of a metallic ring, which can be pushed up on the laid-back end of the blade, or in a particular form of connecting stem and catch, through which it passes, so that when the bistoury is opened, the blade is thrust up, (PERCY's bistoury,) or in a spring, like the common clasp-knife. The latter kind of bistoury is the most convenient.

2599. The utility of the bistoury depends specially on the *form of its blade* ; the length and breadth are of less importance. The following are their distinction according to form :—*a*. The *straight bistoury*, of which the edge runs straight to the tip, which is formed by its narrowing from the back. *β*. The *pyramidal bistoury*, in which the edge and back narrow to the point. *γ*. The *convex bistoury*, of which the blade is convex. *δ*. The *pyramidal bistoury, with a double-edged point*. *ε*. The *bistoury curved, and having a button at its tip* (POTT's bistoury.) The choice of these different bistouries depends upon the special use to which they are applied.

2600. In general the *straight-edged bistoury* is most convenient in all cases, and with it alone can a regular cut be made.

A regular cut must have the same depth from its beginning to its end ; it must not have any bridges, the angles must not be cut more shallow than the middle and the edges must not be jagged.

This cut is to be made in the following manner :—The ulnar edge of the left hand must be placed on the part where the cut is to be made, pressed firmly on it, and the skin tightened from above or below, and with the thumb and forefinger stretched on either side. The bistoury held in the right hand with the thumb, middle, and ring-finger, and the forefinger laid on its back, or held as a pen, has its point thrust directly down to the depth the cut is to be made, then the handle is sunk, and the whole edge is *drawn with equal pressure* over the parts to be cut through. When the cut has been made, the bistoury is again raised perpendicular, and cuts through every thing which still remains undivided in the angle. This is the most common kind of cut.

2601. In many cases, where the skin is easily displaced, or an important part beneath may be injured, a fold of skin may be cautiously made, the one end of which is given to an assistant, the other held by the operator, and the knife drawn across its middle. Sometimes the cut is made from within outwards; the bistoury is then thrust in to a certain depth, and its edge, drawn out to or from the operator, enlarges the opening. This kind of cut has no necessary cause for its employment. It is most commonly made when the bistoury is introduced on a director. If the latter instrument be passed beneath the skin, or into a canal, it must be held with the left hand and in such direction that its end presses towards the skin, which an assistant tightens on either side, whilst the straight bistoury is run along the groove of the director, at an acute angle with it, up to its end, when the bistoury is raised upright to divide every thing up to its tip.

2602. The *convex bistoury* is specially employed for making semicircular cuts, and for the removal of tumours, where a larger extent of blade can be made use of than with the straight-edged bistoury. The *button-ended bistoury* is only used when parts are cut at a depth; the bistoury may then be introduced on the finger of the left hand alone, or on a director to prevent the point doing mischief.

2603. The mode of holding the knife has an important influence on its use; in this respect, four postures, or positions of the knife may be distinguished. *First.* The knife is held like a pen, the handle being taken hold of with the thumb and middle finger near the blade, and the forefinger laid on its back. Herewith the knife can be used with ease, and employed in every direction; it is specially suitable where small cuts are to be made with great care. *Second.* The knife is held with the thumb on one, and the middle and ring finger on the other side of its handle, and the forefinger laid on the back of the blade, as in holding a violin-bow. *Third.* The handle is placed upon the inside of the ball of the thumb, with the thumb on one side, and the middle, ring- and little finger on the other, whilst the forefinger is extended upon the back of the blade. *Fourth.* The knife is grasped with the whole hand, the thumb on one and the fingers on the other side of the handle; this is only applicable to large or amputating knives.

2604. *Scissors* effect the the division of parts, like the bistoury, by drawing and pressure; but the pressure is greater, and therefore the scissor edge is not generally so fine as that of the knife; neither are the edges set directly opposite, but lie beside each other, so that ordinarily, a cut with scissors, is not so clean as that with a bistoury; the parts must also be pressed and squeezed before they are divided. On this account the use of scissors is by many entirely rejected. The objections, however, to the use of scissors may be done away with by the proper fineness of their edge, and by the greater power with which they can be employed.

It has been hitherto supposed that the due degree of fineness, like that of a bistoury, cannot be given to scissors without impairing their strength. I, however, possess scissors made by our clever instrument-maker, GÖRCK, which have the perfect edge of a bistoury, and with proper strength.

2605. Scissors are specially employed to a certain extent for cutting off disorganized parts, for instance, in torn or bruised wounds, to remove the loose flesh in misshapen flaps; in gangrene, to take away the half-separated sloughs and the like; in very luxuriant fungous growths of flesh; but especially for cutting off very soft or yielding parts which have no supporting point, as in cutting the *frænum linguæ*, cutting off excrescences from the mouth, refreshing the edges of harelip, for cutting out a portion of the thickened vaginal tissue in operating on hydrocele by incision, and the like.

2606. Scissors are distinguished according to their form. *a. Straight Scissors*, of which the blades are made pyramidal and run to a point; the point of one blade being pretty sharp, and that of the other somewhat rounded. *β. Scissors curved towards the surface of their blades*, (COOPER's scissors,) or *the blades curved at an angle.* These are used for removing growths with necks, luxuriant granulations and the like, or when they have to act in a cavity. *γ. Scissors curved towards their edge in an arch or at an angle.* The use of the latter (***kneed scissors***, or RICHTER's scissors) have the advantage of being used with more power, and their blades are not so very much drawn back, in cutting (*a*).

Besides these, there are also scissors which have a double curve, that is, towards their blades and their edges, (DAVIEL's Scissors,) which are used for enlarging the cut in the cornea in the extraction of cataract. LEVRET and PERCY's scissors for shortening the *uvula* have been already mentioned. (*par.* 133.)

2607. In using scissors, the thumb and ring-finger are to be passed into the rings of their handles, and that handle held with the fore and middle finger, in the ring of which is the ring-finger. In this way more power is gained than if the middle instead of the ring-finger be put in one ring. The blades of the scissors having been opened, and passed several times between the fingers of the left hand, the parts to be divided are made tense, and then whilst the blades are brought together, the escape of the part from them must be prevented.

2608. As regards the *division of soft parts by stabbing*, it must be observed, that all the instruments employed for that purpose, are formed to penetrate the parts in a peculiar way; consequently the wounds made by them are to be considered and treated as clean cuts. The object of a stab is the discharge of an unnatural collection of diseasedly produced or natural fluids. The instruments for this purpose are the *trocar* and the *lancet.*

The *trocar* consists of a steel stem with a wooden or horn handle, and which runs to a point with three cutting edges, and of a silver canula which ensheaths the stem, behind the part where the three-cutting edge begins, and so ranging with it that there is not the least elevation. Two-edged trocars are inconvenient. The *lancet* consists of a narrow blade, with a cutting edge on either side to its tip and so connected with the two scales of its handle that it can be moved backwards or forwards.

2609. *Tearing* presupposes with the division of connexion, also a tearing and bruising of the part; such wounds there do not heal like a clean cut or stab. This proceeding has only the advantage of the consequent bleeding being less than in dividing with a cut. Hence, it is specially used for polyps.

(*a*) PERCY, Mémoire sur les Ciseaux à incision. Paris, 1784.

2610. The division of parts *by tying or the ligature* is a slow cutting in by its firm tying, in which the divided parts heal, proportionally as the ligature cuts deeper in. This method is always tedious, painful, and should be only employed where the neighbourhood of important parts render the use of the knife dangerous, for instance, in fistulous passages and tumours of various kinds.

3611. The *division of a bone* requires, on account of its hardness and firmness peculiar instruments. Such are performed. *a. After the manner of a cut* with the saw; with the circular saw, the trepan; with the chissel and hammer; with the bone-knife, and with the nippers. *β. After the manner of a stab* with the perforating trepan; and *γ. By scraping*, either with the bonescraper or the exfoliation-trepan.

B.—OF THE SEPARATION OF DIVIDED PARTS.

2612. This operative proceeding in many cases, although not the principal object, yet however is one of the principal acts of the proposed operation. The division of parts happens in most operations, and the indication is to bring them together again. In how many ways this may, and in certain cases should be done, has been already mentioned in considering the treatment of wounds in general.

C.—OF THE DILATATION OF PARTS.

2613. The object of *enlarging* is either simply to obtain a free entrance into natural, unnarrowed openings, as for example enlarging the mouth, the *vagina* and the like by dilators and *specula;* or it applies to the unnatural narrowings of natural passages, and is then effected by the introduction of tents, or elastic bougies, which are gradually selected of larger size; or by such substances, as by attracting fluid, increase in bulk, like sponge tent, catgut, and the like. These remedies are also often employed, after previous cutting, to prevent reunion.

SECOND SECTION.—OF GENERAL SURGICAL OPERATIONS.

I.—OF BLOODLETTING.

(*Abstractio Sanguinis*, Lat.; *die Blutlassen*, Germ.; *la Saignée*, Fr.)

2614. Bloodletting may be performed

First, By opening a vein, *Second*, By opening an artery,	General Bloodletting; or,
Third, By the application of leeches, *Fourth*, By scarification or cupping.	Local Bloodletting.

A.—OF OPENING VEINS.

(*Venesectio, Phlebotomia*, Lat.; *Eröffnung der Venen*, Germ.; *Ouverture de la Veine*, Fr.)

GYER, N., The English Phlebotomy, or Method and Way of healing by Bloodletting. London, 1592. 12mo.

BUTLER, R., M.D., An Essay concerning Bloodletting, &c. London, 1734. 8vo.

WALLBAUM, Dissert. de Venesectione. Götting., 1749.

Dickson, Thomas, M.D., A Treatise on Bloodletting, &c. London, 1765. 4to.

Bücking, Anleitung zum Aderlassen. Stendal, 1781.

Wardrop, James, M.D., On Bloodletting; an account of the curative effects of the abstraction of blood, &c. London, 1825. 8vo.

Hoppe, F., Die Eröffnung der Blutadern. Neisse und Leipzig, 1835.

Abernethy, On the Ill Consequences sometimes succeeding to Venesection; in his Surgical Works, vol. ii. p. 133. Edition of 1815.

2615. *Opening a Vein* (*Breathing a Vein*, in our old common language) may be performed in any of the superficial veins; but usually those of the arm, of the hand, of the foot, and of the neck are preferred.

2616. At the bend of the elbow may be chosen the *cephalic*, *basilic*, *median-basilic*, *median-cephalic*, and the upper part of the *radial* and *ulnar veins*.

In regard to the choice of one or other of these veins, it must be remarked, that the cephalic vein is safest, as far as possible injury of neighbouring parts is concerned, but it is frequently of insufficient size to afford the quantity of blood required; the median, median-basilic, have indeed generally a large diameter and project more distinctly, but they lie in the neighbourhood of the brachial artery, sometimes immediately upon it, and only separated by the tendon of the *m. biceps* and the *aponeurosis* of the arm. It is therefore always, but especially for beginners, best to choose the cephalic or median-cephalic, or the median and basilic near the inner condyle of the upper-armbone, and to avoid the part where the artery is felt pulsating beneath the vein. In very stout persons the veins, although swollen, cannot be seen, but only felt.

2617. In bloodletting from the arm the patient may either sit or lie. The former is best when, the patient not being very weak or confined to his bed, fainting is not to be feared, or fainting may be produced without much blood being drawn. Lying-down is best when the patient is weak, and fainting, even when much blood is taken, is desirable to be avoided. The patient stretches out his arm moderately, and the operator with his forefinger carefully ascertains the situation of the brachial artery, and of the veins at the bend of the arm. A bandage about a yard and a half long and two inches wide, usually of red cloth, is now applied around the arm, a few fingers' breadth above the bend, its middle placed on the front, its ends carried behind the arm, where passing over each other, they are again brought forwards and tied there so tightly with a knot that the return of the venous blood, but not the inflowing of the arterial blood, is prevented. If the vein do not then become sufficiently swollen, the skin at the bend of the arm may be rubbed with a sponge dipped in warm water, or the arm may be allowed to hang down for a time.

2618. The Surgeon now places himself on the inside of the arm, and the patient rests his hand on his hip. He then opens the lancet, the point of which should be neither very narrow nor very suddenly broad, places its blade at a right angle with its scales, and puts it by them between his hips, and with its point directed to the opposite side, so that he may take it again with his hand. He next places his left or right hand, according as he has to bleed in the right or left arm of the patient, upon the elbow-joint, so that he can steady the vein which he has to open, with his thumb. This being done, and the blood stroked down a few times with the unoccupied hand, he takes the lancet with the thumb and forefinger in such way that only so much of the point should project as is sufficient for the depth of the opening. The middle, ring- and little finger of the hand holding the lancet, are now placed upon the arm, and the thumb and forefinger brought to and so dropped on it, that when they are stretched out, the point of the lancet may penetrate obliquely into the vein, immediately on which the blood shows on the lancet-blade, and the fingers being raised, the opening in the vein is enlarged, and the spouting blood is to be caught by an assistant in a proper vessel. The operator now passes to the outer side of the arm, supports it, the one hand being applied to the fore- and the other to the upper-arm without altering its position ; or he allows the patient to grasp the end of a stick resting on the ground.

[This mode of bloodletting is not the best that can be employed, and the management of the lancet is both awkward and bad, and if, as is occasionally absolutely necessary, a vein running over an artery have to be opened, the pushing the point of the lancet obliquely into the vein is dangerous, as though the vein be wide, it may not have much thickness, and its coats both behind as well as before, together with whatever may be behind, may be pierced even by the most clever operator. The readiest and best method is, after selecting the vein, to grasp the fore-arm just below the elbow, with one hand, the thumb of which is to be placed firmly upon the vein, just below where it is to be opened, and which is quite sufficient to steady it. The little finger of the hand holding the lancet is then to be rested just below the thumb of the other hand, with the other fingers piled upon it, in such way, however, as to leave the thumb and forefinger with the lancet quite at liberty, and above the skin, so that the point of the lancet may be capable of a swinging motion from below upwards, and then by sinking the lancet point and making it perform the swinging motion, the front wall only of the vein is wounded, and at the same time the wound in the skin being made rather larger than that in the vein, a free opening is afforded for the escape of the blood, and thus a *thrombus*, which is often the consequence of opening the vein, as recommended by Chelius, and very commonly practised, is prevented.—J. F. S.]

2619. When the proper quantity of blood has been obtained, the knot of the bandage is to be untied, the wound and its neighbourhood cleaned with a moist sponge, the wound covered with the thumb of one hand, whilst with the other, a little compress is slipped from the side of the arm, over the wound, which it presses on the removal of the thumb. The compress is then steadied by putting the thumb upon it, and after bending the arm, fixed with a bandage, which is to be carried round the elbow in several figure of 8 turns. The arm is to be kept quiet.

2620. The particular accidents which may occur during the operation are, *α*. *A faulty stab*, in which case the operation must be repeated. *β*. *The formation of a too small opening ;* the wound must then be enlarged, or another place chosen. *γ*. *Stoppage of the flow of blood*, by displacement of the skin when the arm is moved into some other position ; the arm must then be restored to its proper place, and be a little more bent, the blood stroked upwards, and the hand moved ; or from the bandage being tied too tight, which must then be slackened , or from the aperture being stopped up by a little lump of fat, which may be brushed away with the sponge or cut off ; or from extravasation of blood in the neighbourhood of the wound, in which case the operation must be repeated elsewhere ; or from fainting, when the patient must be revived with fresh air, sprinkling with cold water, and the like. *δ*. *Severe pain from wounding a nerve.* *ε*. *Wounding an artery*, which may be known by arterial blood spouting out together with the venous, by arterial blood continuing to flow after the removal of the bandage, and by it not being checked by pressure below, but above the wound. The treatment in this case consists of pressure and binding up the arm as already mentioned. (*par.* 386.) *ζ*. *Wound of a lymphatic vessel*, *of a tendon*, *or of the aponeurotic expan-*

sion, which is only rendered apparent by symptoms which come on afterwards.

2621. The bandage must remain if it do not slip, or no particular symptoms ensue after the operation till the third or fourth day. The accidents which may occur after the operation, are, *α. Bleeding*, if the bandage slip; it must be replaced. *β. Inflammation and suppuration*, in consequence of inflammation of the *aponeurosis*, of too tight bandaging, of movement of the arm, or of the state of constitution. Perfect quiet, loosened bandage, application of compresses soaked in lead wash, soothing poultices, and if collections of pus be formed, opening them become necessary. *γ. Inflammation of the veins or lymphatic vessels*, which, according to its degree, requires a more or less active antiphlogistic general or local treatment. ABERNETHY has, in inflammation of veins, advised the application of pressure above the wound, in order to effect the union of the walls of the vein, and to prevent the spread of the inflammation. *δ. Severe pain*, even convulsions in consequence of partial division of twigs of the external subcutaneous nerve, when the median-cephalic vein has been opened, or of the internal subcutaneous nerve when the median-basilic has been opened. In such case, ABERNETHY advises complete division a little above the wound in the vein, which is, however, rarely followed, and proper antiphlogistic and antispasmodic treatment may be more fitting.

I have not referred to the employment of the *Snapper*, because on account of its uncertainty and danger, the stroke may be made too deep, too shallow, or inefficient, and the fleam be broken off; it cannot be compared with the use of the lancet, but may also be very dangerous in unpractised hands.

2622. The veins of the fore-arm are, however, to be preferred for opening, when in very stout persons, those at the bend of the arm cannot be opened with certainty. But on account of the numerous plexuses of nerves surrounding them, their opening is perilous, and it is better to choose the *vena cephalica* or *salvatella* upon the hand; the former, however, has often a branch of an artery running beneath it, and the latter is very small.

2623. In *Bloodletting in the foot*, after putting the foot in a tub of warm water, a bandage is to be applied as in bleeding from the arm, a little above the ankle, the foot put on the edge of the tub, and the lancet carried as already described, into the swollen *vena saphena interna* or *parva*. The foot must then again be put into the tub of water; or if a certain quantity of blood be required, it must be caught in a vessel. The dressing is to be similar to that for bloodletting in the arm.

2624. The external jugular vein is selected for *bloodletting in the neck*. An assistant standing behind the patient, who sits up in bed or upon a stool, holds the head with one hand, and with the thumb of the other presses the external jugular vein, whilst the operator compresses it with his left thumb at the part where the opening is to be made. The jugular vein may also be compressed on the opposite side without the aid of an assistant; in doing this a compress is placed upon it above the collar-bone, and fastened with a bandage carried around the chest and back from the armpit of the other side. The vein is to be opened with a lancet from below upwards, and from within outwards, so that it may not be covered by the neighbouring fibres of the *m. platysma myoides*; and the blood may be allowed to flow along a gutter-shaped piece of pasteboard into a vessel. When the dressing is applied, the compress must be removed, the edges of the wound pressed together, sticking plaster and a compress put over it, and fastened with a bandage.

B.—OF OPENING ARTERIES.

(*Arteriotomia*, Lat.; *Schlagader-Oeffnung*, Germ.; *Ouverture de l'Artère*, Fr.)

2625. *Opening an artery* is only performed on the temporal; it is recommended in severe inflammation of important organs, as the brain, the eye, and the like, so as quickly to evacuate a large quantity of blood.

This operation is best performed in the following way: the pulse of the temporal artery, or one of its branches, is sought for in the temporal region: the place is to be marked with a black streak, the skin raised in a fold and cut through. The artery is then easily found and opened in a rather oblique direction with a lancet. The proper quantity of blood having escaped, the artery is to be cut through, taken up with the forceps and tied, and the skin closed with sticking plaster. This method is more certain than opening the temporal artery at a stroke with the lancet, and stanching the bleeding by pressure.

[Opening the temporal artery is oftentimes far less easy than might be expected, and inattention to its subsequent division frequently causes very serious and sometimes fatal results. The facility with which it is found depends pretty much upon the part at which it is opened. If this be done just before and above the *tragus*, it is managed easily on account of the size of the vessel; but if higher, after its division into temporo-frontal, and temporo-occipital, it is more difficult; the temporo-frontal branch, which is the part of the vessel commonly chosen, as it runs along the edge of the hair, diminishes quickly in its course, so that the higher it is operated on, the more difficult is it to be found. If it be expected that a single bloodletting from one or both temporal arteries will alone be required, then the artery may be opened in front of the auricle, upon, or a little above the root of the zygomatic process. But if it is likely that more than one bleeding from each vessel will be required, then it will be better to open the artery upon the forehead, which will give the opportunity of repeating the operation again and again, each time below the former one, till the root of the zygomatic process be reached. The younger CLINE used to advise that in the performance of this operation the artery should be laid bare lengthways to the extent of half an inch or an inch, that a tenaculum should be passed across and behind it, so that the vessel could be raised, more readily punctured, and what was of infinitely greater importance, more certainly divided after sufficient blood had been obtained. Inattention to the division of the temporal artery after it has been opened, is occasionally followed by a spurious aneurysm, which cannot always be managed by compression, or even by tying the ends, and patients have been destroyed by after-bleeding wearing out the powers of the constitution. In general, cutting the artery completely across, and the application of pressure, are sufficient; but when the vessel continues bleeding, both its ends must be tied, as the anastamosis is so free upon the head, that if only one be tied the bleeding continues. The same practice must also be followed when spurious aneurysm of this vessel occurs after arteriotomy.—J. F. S.]

C.—OF THE APPLICATION OF LEECHES.

2626. In applying leeches, they may be held with a piece of linen round their hind part, so that the head, which is always their thinnest part, may be directed to the spot upon which they are to be fixed. This spot must always be carefully cleaned. Some persons apply leeches in a piece of pasteboard rolled up, or in a glass cylinder. When the part permits, it is most convenient to put the requisite number of leeches into a cupping-glass, and turn it down.

The Blood-Leech (*Hirudo medicinalis*, Lin.) is distinguished from the horse leech and the common leech, which are never so large, by six orange-coloured stripes running from the head along the back and sides to the tail. The back and sides of the horse leech are of a blackish-brown or blackish-gray colour, without any marking; the common leech is light brown, spotted with black, and without other marks. The belly of the blood-leech is steel-blue, with regular yellow spots, but the latter are often so numerous that they are mistaken for the ground colour, and the steel-blue for the spots; in rare instances, the yellow spots are entirely wanting, and the whole belly is simply steel-blue. The belly of the horse-leech is yellowish-gray, and that of the common leech, grayish-brown. Leeches are best caught in the spring, because in winter they do not so readily find food. Rain water is better to preserve them than river or distilled water. The glass in which they are kept should not be in the sun-light, and they should especially be put in a cool rather than in a warm place. Frequently changing the water is hurtful (*a*).

2627. If the leeches will not bite, the part on which they are to be applied must be smeared with spittle or sugar and water, or the skin cooled with cold water, or it must be slightly scratched and smeared with the blood. Leeches oftentimes will not take, because when previously at liberty, they had sucked freely; their belly is then full, and such should rather be chosen in which it is sunken. They are generally allowed to remain on till they drop off; but if necessary to get them away before, they must be sprinkled with a little salt or snuff. The after-bleeding is to be kept up by bathing the bleeding parts with sponges dipped in warm water. The recommendation of cutting off the leech's tail, if it be desirable they should suck long, is absurd, as they soon after drop off. I have seen one leech which was uninjured, remain on six-and-thirty hours, and the blood flowed from its tail.

In the application of leeches in the mouth, care must be taken that they do not crawl down and fix in the throat, or be swallowed. In the latter case, a quantity of salt and water should be swallowed, and an emetic taken. If leeches be applied in the neighbourhood of the *anus*, that should be stopped up with a wad of lint.

[CRAMPTON and OSBORNE (*b*) recommend the application of leeches to mucous surfaces, having first passed a thread through the animal's tail, and then directing its mouth by means of a probe, or channel made with card, to the part desired.]

2628. After the leeches have dropped off, bleeding may generally be kept up for some time by sponging with warm water; but if it be wished to stop it, this may be done by bathing with cold water and applying German tinder.

Sometimes, especially with little children, the bleeding is very severe, and may easily be fatal if unattended to. The means here advised for stanching the blood are, strewing the part with styptic powders, with gum tragacanth, the introduction of a small portion of lint into the little wound, holding the skin in a fold and pressing it together with the fingers or a proper instrument, cauterization of the part with a red-hot needle, the introduction of a common sewing-needle on one side through the skin to the bottom of the wound, and out at the other side some distance from the wound and the needle, the ends of which are covered with wax, is then to have twine twisted round so as to compress the wound firmly (*c*). HENNEMANN (*d*) has invented a particular kind of forceps for this purpose. LOWENHARDT (*e*) penetrates superficially the edges of the wound brought together, with a fine needle and thread, and after removing the

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(*a*) KUNZMANN, Ueber die Function der Lauge-organe des Blutigels, dessen Anwendung und Aufbewahrung; in VON GRAEFE und VON WALTHER's Journal für Chirurgie und Augenheilkunde, vol. ii. p. 262.—SCHMUCKER, Historischpraktische Abhandlung von medicinischen Gebrauche der Blutigel; in his Vermischte Schrifte, vol. i. sect. ii.—OTTO, Der Medicinische Blutigel. Weimar, 1835.

(*b*) Dublin Journal of Medical Science, vol. iii. p. 340.

(*c*) WHETE; in VON GRAEFE und VON WALTHER's Journal, vol. i. p. 185.

(*d*) RUST's Magazin, vol. xvi. part iii. p. 375.

(*e*) VON GRAEFE und VON WALTHER's Journal, vol. xv. p. 119.

needle, ties the thread in a simple knot. If no after-bleeding ensue, the thread in a few days drops off of itself.

[The employment of leeches in the treatment of inflammation is so commonly unattended with inconvenience, that it would seem scarcely worth while to refer to the subject. But frequently the bleeding from the wounds caused by them is very considerable, and very difficult to stop; sometimes threatening danger from the quantity of blood lost, and occasionally destroying the patient. It is, therefore, well worthy a little consideration. Dangerous bleedings from leeches occur in adults as well as in young children. Of the former kind, are, the case of a stout country lad who died in La Charité, of bleeding from a single leech bite on the belly in twenty-five hours, related by Brichetau (*a*); that of an old woman in La Pitié, under Lisfranc (*b*), to whose belly leeches had been applied; she went on well for three days, retired to rest at night apparently well, but on the following morning was found dead in her bed in a pool of blood. My friend Green, some years since, had a man in St. Thomas's who died of bleeding from the temporal artery, which had been bitten by a leech. Of the latter kind, the case of a child of nine months, who died in a night after a leech-bite, is recorded (*c*). No such fatal cases have come under my own care; but I have frequently seen the bleeding continued for several days, so as to render the patient pale as ashes, and weakened as under severe loss of blood under any circumstances. The cause of the bleedings is either from an artery being wounded by the bite, as in Green's case certainly, and probably also in Brichetau's, and in a case of bleeding from leech-bite on the temple, mentioned by Oliver (*d*); or from that incapacity of the blood to coagulate occasionally observed in peculiar constitutions, of which I have seen many instances, and which, unless properly treated, as surely, though sometimes more slowly destroy the patient, as if an artery had been wounded and left undivided or untied.

The treatment recommended for these cases is very various, and must necessarily vary according to their cause and situation. In the more trivial cases the application of rag repeatedly dipped in cold water, so as to reduce the vascular action of the part is often sufficient, either with or without pressure, which is advantageous when it can be made efficiently, as on the head and chest, and also, though less advantageously, on the limbs; but upon the belly pressure is of little avail, as from the yieldingness of the parts, it cannot be continuous. If a vessel, as for instance, the temporal artery, be wounded, it is best at once treated by division between the wound and the heart, as practised in arteriotomy. This plan will succeed if done early; but it will not always answer, if put off till the formation of spurious aneurysm, as in Green's case. Or the vessel may be found and tied. Or it may be compressed firmly between the bone and a piece of cork bound tightly on, either with or without division of the artery, as in common cases of the wound of such vessel. If the leech-bite be on a yielding part, Löwenhardt's (*e*) method of drawing the edges of the wound together with a fine needle and thread may be employed. But I prefer thrusting a couple of needles at right angles to each other, at a little distance from the aperture below the bottom of the wound, and out at the opposite side; around which, including the whole bite, a strong thread is to be carried once or twice and tied tightly. After two or three days the thread and pins may be removed, and the bleeding has generally been stopped. Oliver has recommended, from his own experience, the application of plaster of Paris (*f*), and particularly mentions a case which was cured by this treatment, in which a pint of arterial blood was lost from the temple (*g*), and perhaps the temporal artery was wounded. Ridalfo (*h*) of Leghorn recommends the application of a cupping glass, which done, he says, a coagulum forms immediately, and he advises that the glass should be left on for a few minutes. On the other hand, Sir J. Murray (*i*) advises the employment of condensed air in a syringe; but it is rather difficult to make out whether he has had practical experience on this point. The introduction of nitrate of silver, scraped to a very fine point, into the bottom of the leech-bite, is, so far as my experience goes, not so successful as related of twenty-two cases, infants and adults (*j*), after the plan recommended by Donovan (*k*). In slighter cases a saturated solution of German tinder may be successfully used. Howison (*l*) says, that a thick layer of flour dusted on flannel

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(*a*) Gazette des Hôpitaux, vol. vii. p. 36. 1833.

(*b*) Revue Medicale. 1827, vol. iv. p. 149.

(*c*) Lancet, 1829-0, vol. ii. p 394.

(*d*) Ibid., 1834-5, vol. i. p. 304.

(*e*) Above cited; quoted in Lancet, 1828-9, vol. ii. p. 400.

(*f*) Lancet, 1833-4, vol. ii. p. 208.

(*g*) Ibid., 1834-5, vol. i. p. 30[illegible].

(*h*) Ripertorio di Medic. e di Chirurg. di Torino; quoted in Lancet, 1828-9, vol. i. p. 232.

(*i*) On the local and general Influence on the Body of increased and diminished Atmospheric Pressure; in Lancet, 1834-5, vol. i. p. 916.

(*j*) Lancet, 1829-30, vol. ii. p. 927.

(*k*) Annals of Pharmacy.

(*l*) Medical Gazette, vol. vi. p. 207. 1830.

is very rapid and efficacious in stanching bleeding leech-bites. One or other of these plans are almost invariably used and succeed, except when the blood cannot coagulate, and which is indicated by the failure of these means, and not unfrequently by the history of the case; under such circumstances it is necessary to use the actual cautery, or to express it more simply, a piece of thin iron wire heated red hot and thrust down to the bottom of the wound; and this treatment is almost universally successful, for it seems that the actual fire has some peculiar effect upon the wounded vessels more than other escharotics have. I cannot explain in what this consists, but from repeated observation, I know that a red-hot iron wire will stop bleeding, when all other means have entirely failed. The introduction of small bits of hard-rolled sponge I entirely disapprove of, on this, as well as on most other occasions.—J. F. S.]

2629. If considerable *ecchymosis*, inflammation and suppuration should occur, the parts must be bathed with lead wash, or lead ointment should be applied.

D.—OF SCARIFICATION.

(*Scarificatio*, Lat.; *Scarificiren*, Germ.; *Scarification*, Fr.)

2630. *Scarification* consists of more or less deep cuts with a lancet or bistoury in any one part, whereby it is emptied of the fluid it contains. It is more frequently employed in inflammation of those parts where leeches cannot well be applied, as for instance, inflammation of the tongue, of the gums, of the tonsils and the like. In considerable inflammatory swelling of such parts as are surrounded with unyielding *aponeuroses* or very thick cellular tissue, scarification, besides the local bleeding, produces also a lessening of the tension. It is also employed after the bites of rabid animals, under certain circumstances in gangrene, and in callous ulcers. Scarifications of the dropsical swelling of a part must be made quite superficially, and never then if there be accompanying erysipelatous inflammation, or a great degree of exhaustion, because gangrene generally follows.

E.—OF CUPPING.

(*Applicatio cucurbitarum cum incisione*, Lat.; *Schröpfen*, Germ.; *Ventouses*, Fr.)

2631. *Cupping* differs from scarification, in that before the skin is cut into at any one part and in different directions, with the *scarificator*, or a *bistoury*, congestion of blood is promoted in it, by the application of a *cupping glass;* and afterwards a suitable quantity of blood may be drawn.

2632. When the part to be cupped has been rubbed with a sponge dipped in warm water, a cupping glass is held over a burning lamp to properly expand the contained air, and then as quickly as possible, and cleverly applied to the spot chosen. After a few minutes, when the skin has been properly drawn up into the cupping glass, the glass must be removed, whilst the forefinger is slipped under its edge. Upon this part the scarificator is now placed, after having set the lancets and drawn up the spring, and then pressing upon it, the lancets wound the skin. A lancet or bistoury may be used instead of the scarificator, with which more or less deep cuts are made upon the part chosen. For the purpose of discharging the blood, a cupping glass is to be again applied in the way already mentioned; and when nearly full, it must be removed, the part cleansed and the glass put on again. The cut may be repeated in any direction with the scarificator. When no more blood flows, the part must be cleaned and covered with a firm compress.

Dry cupping consists simply in the application of cupping glasses without scarification, and is for the purpose of drawing the blood to any one part.

[As occasionally scarificators and cupping glasses are not at hand, the following substitutes, which I recollect having heard a friend in the military service mention, may be employed. Some short incisions near each other are to be made through the skin, and over them is to be whelmed a tumbler, wineglass or teacup, the air in which is to be exhausted or rarified by burning within a piece of paper.

Instead of a scarificator, Dr. Osborne (*a*) proposes his *polytome*, which consists of several lancets with circular edges fixed parallel in a frame, with a handle. It is drawn quickly along the skin, so as to make incisions an inch in length, and one-sixteenth or one-eighth of an inch deep. He supposes a better flow of blood will be procured by this instrument than by the scarificator.

Cupping is sometimes attended with danger and even loss of life, either from wounding an artery, or from inability of the blood to coagulate. Of the latter kind it has been several times noticed, when cupping has been employed during an attack of jaundice, that very tiresome and dangerous hæmorrhage ensued from the want of coagulability of the blood. In one case which came under my care a few years since, all kinds of styptics and escharotics were used in vain, at last I employed the actual cautery, which stopped the bleeding, and the patient did well. In another case, in which a girl had been taking for some time nitrate of silver on account of epilepsy, and for some cause or other she was cupped on the loins, continued hæmorrhage from the wounds ensued, which nothing could stop, not even the actual cautery, and the patient bled to death.—J. F. S.]

2633. In regard to the preference of leeches, or cupping for local bloodletting, it may be observed, that in general the former are more convenient as they can be applied on every part, and their effect is not attended with so much irritation as from cupping. But the latter circumstance gives an undeniable preference to cupping over leeching in many cases of chronic, deep-seated, especially rheumatic or arthritic inflammation, as not merely is the bloodletting, but also powerful derivation to the skin effected, as for example in *sciatica*, *lumbago*, and many affections of the joints and the like (1).

Sarlandiere's (*b*) bdellomètre corresponds to cupping.

For the purpose of effecting a powerful derivation of blood, without an actual bloodletting, Junod (*c*) has invented an apparatus consisting of a glass cylinder to enclose the whole limb, around which it closely and air-tightly fits at the upper end. At the lower end is a cock, connected with an elastic tube and an air-pump, by means of which the air is drawn out of the cylinder. As this is done, the skin expands and reddens, the size of the limb is increased, the temperature raised, and transpiration becomes so profuse, that it collects on the walls of the cylinder. At the same time the head becomes light, the countenance pales, the pulse in the temporal artery slow, thready and faint; swooning ensues and sometimes *nausea*. By this apparatus, severe pressure with air can also be effected; by which the limb is rendered pale, the superficial veins are emptied, the bulk of the part diminished, and the circulation interrupted. After the operation the limb remains considerably lighter, and moves more securely and easily. Moreover, especially when it has been used upon one of the lower limbs, dizziness, rushing in the ears, seeing sparks, disposition to apoplexy, and difficult respiration have been produced.

[I cannot agree with Chelius in his preference of leeches over cupping, as causing less irritation, for I have witnessed the contrary again and again. The leech-bites, specially in persons with irritable skin, often fester, and I have occasionally seen tedious sores, and difficult to be healed resulting from them. They also not uncommonly are attacked with erysipelatous inflammation, which, though generally yielding to a bread poultice, sometimes assumes a serious character. The danger ensuing from their occasional disposition to bleed indefinitely has been already mentioned (*par.* 2028.) And even under the most favourable circumstances, the quantity of blood obtained by them is very uncertain, and the exhaustion of the patient by exposure, and mopping the parts

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(*a*) Observations on Local Bloodletting; in Dublin Journal of Medical Science, vol. iii. p. 334. 1833.

(*b*) Bdellomètre. Paris, 1818 8vo.

(*c*) Bourgery, Traité complet de l'Anatomie de l'Homme, comprenant la Médecine Opératoire, vol. vi. pl. 83.—Froriep's Chirurg. Kupfertaf., cccxcvii.

with a sponge, it may be for hours together, render their employment far from desirable, excepting on parts where cupping cannot be performed on account of disfigurement as on the face, or where the parts are too yielding, so that a cupping glass would be almost filled by them, as on the belly, or where important vessels and nerves are in the immediate neighbourhood, as in the neck and the like, or where there is merely a small inflamed lump, upon which a cupping glass cannot be conveniently applied. With these exceptions cupping is infinitely preferable to leeches, and more especially as a determinate quantity of blood can be obtained with little additional pain for a short time, the whole operation being generally completed in half an hour or less without fatigue to the patient. So far as I have noticed, the after-irritation of cupping is very far less frequent than that from leeching, and therefore from all these circumstances I should always recommend cupping rather than leeches, where it can be employed.—J. F. S.]

II.—OF PUTTING IN ISSUES.

(*Fonticulus*, Lat.; *Fontanelle*, Germ.; *Fonticule*, Fr.)

2634. By the term *Issue* is meant an artificially produced, and continually suppurating wound, which is made either with the knife, with blister plaster, with the actual cautery, or with caustic. The latter two will be specially considered afterwards.

The place for the issue is determined by that of the disease which calls for it, though generally a part is chosen where much cellular tissue is beneath the skin, usually between two muscles, on the arm between the *m. biceps* and the *m. deltoides*, on the thigh between the *m. vastus internus* and *m. gracilis*, on the calf between the *m. gastrocnemius* and *m. soleus*, on the breast between two ribs and so on. Large vessels and nerves must be avoided.

2635. When using a bistoury, a small fold of skin must be nipped up and cut through lengthways, and the wound stuffed with a little wad of lint, and covered with sticking plaster. On the second or third day the dressing should be taken off, the wound cleaned, and one or more peas put into it (1). A square piece of sticking plaster and a compress are put on and fastened with a bandage. The issue must be dressed daily, once or twice, according to the degree of suppuration, and always properly cleansed.

[(1) The best and cleanest materials for issues are little, solid, glass beads, which soon embed themselves, and not swelling like peas, excite little irritation, and may be worn for months, merely taking them out for washing every day, and returning them to their bed.—J. F. S.]

2636. If on account of the patient's dread of the knife, a blister be employed, a round piece about half an inch in diameter, must be applied and kept on till vesication take place, when it is to betaken off and the cuticle removed. One pea is then to be put upon the exposed part, fixed with sticking plaster and pressed with a bandage, so that the pea may sink into the skin. The after-treatment is the same as in the former case.

2637. If the issue cause violent pain, the pea must be removed, or if there be several, their number must be diminished; this must also be done if there be much inflammation, and lead wash applied over. If there be not proper suppuration, the pea must be smeared with digestive salve, the issue touched with lunar caustic and the like. If the suppuration be too great, the pea must be removed. If fungous flesh grow up around the issue, it must be got rid of by touching with caustic or cut off with scissors. If the part waste in which the issue is, it must be moved elsewhere. The issue must not be allowed to heal too quickly.

The method of proceeding employed under the name of the *English Issue*, is, in its application, very agreeable to the patient.

III.—OF INTRODUCING A SETON.

(*Setaceum*, Lat.; *Eiterband*, *Haarseil*, Germ.; *Séton*, Fr.)

2638. The *Seton* consists of a strip of linen unravelled at each edge, or of a strand of several cotton, silk or hempen threads, which are drawn into the skin or into any tumour, to keep up a continual discharge, and a certain degree of inflammation, for the purpose of diminishing any tumour by continued suppuration, and to keep up the passage through any canal. The introduction of a seton is managed in different ways.

2639. If the seton be passed through the skin, a fold of skin must be lifted up vertically in the neck, with the finger and thumb of the left hand, and pierced at its base with the seton-needle, in the eye of which is the strand of threads or strip of linen, and as the needle is drawn out, these follow it. If there be not any seton-needle at hand, the raised fold of skin must be pierced with a double-edged bistoury, and an eyed probe armed with the seton-threads carried through the opening thus made. Both openings are to be covered with a wad of lint, which is fastened with sticking plaster, and the loose ends of the seton put into a compress, and retained with a proper bandage.

[Of late an Indian rubber tape, about three-eighths of an inch wide, and a line thick, has been used instead of threads or linen, for a seton. It is much better than either of the latter, as it does not get loaded with matter and become offensive. It is easily passed, after thrusting a double-edged bistoury through the skin, through the opening thus made.—J. F. S.]

2640. Passing a seton into a cavity containing fluid, for instance, an abscess, is to be managed as already directed (*par.* 57); or a somewhat curved silver canula is used, with a stilette, of which the front end has a trocar point, and its hinder end an eye, through which the strand of threads is threaded. The swelling is to be pressed, so that it may be made sufficiently prominent, and the canula well oiled, with its point projecting, must be thrust through its lower part into the cavity of the swelling, then the point of the stilette drawn back, and the end of the tube carried to the upper part of the cavity pressed against the skin, and then the stilette thrust through. The tube is now drawn out at the lower, the stilette at the upper wound and the threads introduced into the cavity.

2641. If the seton be passed into a swelling which does not contain fluid, either a seton-needle or a stillette with a trocar point and an eye must be used and carried in such direction, and so deeply through the mass of the tumour as not to run any risk of danger from wounding any considerable vessel or nerve.

2642. After the seton has been introduced it may be left alone for some days till suppuration be set up in its track; then, after removing the dressings and washing off the crusts at the wounds with lukewarm water, a fresh portion of the seton may be drawn through, the part already used cut off some distance from the wound, and the dressing renewed. In this way the seton is to be managed daily, once or twice a day, according to the degree of suppuration and the object purposed. If requisite, other remedies may be smeared upon the seton strand, and with it drawn into the canal of the wound; and when the strand has been used up, a new one may be attached to and drawn through with it. If the seton strand require thickening, more threads are to be added to it; if it need thinning, some must be taken from it; the strand or linen band must be gradually thinned, and when it is drawn out, moderate pressure applied. If there be bleeding in passing the seton-needle, it must be stopped with cold water or pressure. Severe inflammation requires the seton to be smeared with fresh oil, or simple cerate and soothing applications. If the suppuration be profuse, strengthening remedies are to be employed, both externally and internally.

IV.—OF THE APPLICATION OF BLISTER-PLASTER AND MEZEREON BARK.

(*Vesicatio*, Lat.; *der Setzen der Blasen-pflaster, und der Seidelbastrinde*, Germ.; *le Vésicatoire, et le Garou*, Fr.)

2643. The effect of *Blister-plaster* is more or less severe irritation of a part kept up for a longer or shorter time. For this purpose *Spanish Fly Plaster* (*Emplastrum Cantharidis*) is used, spread on linen or leather, applied to the part required, and bound on with strips of sticking plaster, a compress, and bandage, but not too tightly, or severe pain will be produced, and the formation of a blister prevented. The time a blister should remain on varies acccording to the object of its application, the constitution and age of the patient.

[The most cleanly, and as efficient a way of producing a blister, as with a plaster, is the use of a fold or two of lint, sopped in *acetum cantharidis*, and applied to the part for a few hours; or on irritable or thin skin, it will be merely requisite to apply it freely with a camel's-hair brush to the extent required. Recamier and Trousseau have, for the same purpose, applied lint dipped in a strong solution of ammonia.

When it is considered necessary to produce blistering as quickly as possible, other remedies have been resorted to, which are in fact only purposely-made burns and scalds, and will require at least some little caution in their use. Pigeaux (*a*) applies a piece of lint, cloth, or paper, of the necessary size, just previously dipped in spirits of wine, and passing a match rapidly over it, at once sets it a light, it is extinguished, and then the skin may be removed, leaving the *cutis* perfectly dry and unharmed. (On the contrary, I should think the dryness were a tolerable proof that a slough had been produced.—J. F. S.)

Boiling water has also been poured in a thin saucer upon the part to be blistered, or by soaking a sponge, and and applying it for a few minutes, but not long enough to destroy the *cutis*. Sir Anthony Carlisle recommended the application of a spatula dipped in boiling water; in other words, a gentle burn.

Blisters are often left, as to their mode of application and the length of time they are to be kept on, entirely to the will and pleasure of an ignorant nurse, and the patient consequently suffers much more pain than necessary, and sometimes, also, has sloughing of the *cutis*, which, if the patient be a female, and the blistered part be the neck or any other visible part, will get the medical attendant into much trouble, which he deserves; though occasionally, even with the greatest care, this tiresome accident will occur when the skin is irritable.

In applying a blister, one of the greatest inconveniences arises from some of the little pieces of fly sticking to the skin, or even to the *cutis*, if the skin break whilst the blister is applying; this much increases the pain and irritation, and can be very easily avoided, by merely laying a piece of tissue paper or any other thin paper between the plaster and the skin, and if the plaster be bound firmly on, it will operate as readily through the paper as if it were in immediate contact with the skin.

A blister is often directed to be kept on twelve or twenty-four hours, which at least is a great absurdity, and may be very inconvenient to the patient. It is only necessary to keep it on till the whole of the skin beneath it has fairly separated from the *cutis* and the serum has begun to be poured out, which in most persons will take place in six or eight hours. But with children even this will not do; the blister should be removed as

(*a*) Bulletin de Thérapeutique, vol. ii. p. 176.

soon as it has caused bright redness of the skin, which generally happens in two or three hours; it should then be removed and left alone for a little while, as the blister very soon after rises, if it have not already. The younger the child is, the more necessary it is to attend to this point, or sloughing will ensue, and death has been known to follow in consequence.

Indeed with children, I am by no means sure that, in most cases, a mustard poultice is not preferable to the application of a blister. It should be made with mustard and warm water, (some recommend vinegar,) rather thinner than if for the table, as if made stiff it is much less active. It should then be spread about a quarter of an inch thick on fine muslin, and another layer of muslin being put upon it, applied to the part, and kept on ten, fifteen, or twenty minutes, according to the redness and pain. In some persons it will even blister. When removed, the skin should be carefully sponged clean with warm water, otherwise the irritation, which is very great, will continue.

In the few persons whose skin is blistered with difficulty, it is best to apply previously a mustard poultice till the skin becomes reddened and painful.—J. F. S.]

2644. When the blister has risen, the plaster must be carefully removed, the blister opened with scissors, the water emptied, and the part dressed with simple cerate, fresh butter, or any other mild ointment. If requisite to keep up the suppuration for a time, it must be dressed with *ung. resinæ*, or some digestive ointment to which *cantharides* has been added, or with *ung. sabinæ*, which is best of all.

[I must confess I am no advocate for open blisters, the only special result of which appears to me that of putting the patient to unnecessary pain. All that is desirable, to wit, derivation, is much more effectually done by a succession of small blisters, about the size of a half-crown piece, around the part affected, which may be repeated *ad infinitum*, with scarcely any inconvenience to the patient. They are called *flying blisters*.—J. F. S.]

2645. When a blister is applied to a part not very sensitive, its operation may be promoted by rubbing it with a hot flannel or with vinegar.

If the inflammation be very violent, it must be soothed with some softening and cooling remedy. If the *cantharides* be absorbed, it will produce strangury, for the relief of which, mucilaginous drinks and emulsions with camphor, may be given. Swellings of the neighbouring glands, which sometimes arise, may be relieved by the application of soothing ointments and poultices, and by the removal of all irritation.

2646. For the employment of *Mezereon bark* (*Seidelbast*, Germ.) a piece of the bark an inch and a half long, and the same wide, should be soaked eight or ten hours in vinegar or water, after which, it is to be applied with its smooth surface next to the skin, generally upon the arm, at the insertion of the *m. deltoides*, and covered with a piece of oiled silk compress, and roller, to keep it close. After ten or twelve hours, when the bandage is removed, if the skin be sufficiently inflamed, a piece of oiled silk is to be applied on the inflamed part and fastened with compress and bandage; but if the first application have not been effective, a second piece of the bark must be applied. About the second or third day a new piece of bark is put on, the skin rises, and a serous fluid exudes. The part must be cleansed daily with warm water or milk; and if the inflammation be very great, it must be rubbed with warm milk and bound up with some mild ointment. The pustules around the irritated part in general yield to cleanliness and repeated washing with warm water.

[2646.* Another very excellent and very gentle mode of blistering is with croton oil, ten or a dozen drops of which should be gently rubbed over the surface with the finger, protected in a piece of oiled silk, for two or three following nights. Usually a slight stinging is felt, accompanied with puffiness of the part on the second or third day, and this is followed by a crop of small vesicles, which speedily maturate, in a day or two after dry up, and fresh cuticle is formed. It is one of the best modes of blistering, if not required to be speedy.—J. F. S.]

V.—OF VACCINATION, OR INOCULATION WITH COW-POCK.

(*Vaccinatio*, Lat.; *Einimpfung der Kuhpocken*, Germ.; *Vaccination*, Fr.)

Jenner, Edward, M.D., An Inquiry into the Causes and Effects of the Variolæ Vaccinæ, a Disease discovered in some of the Western Counties of England, particularly Gloucestershire, and known by the name of Cow-pox. London, 1798. 4to.

Ibid., Further Observations on the Variolæ Vaccinæ, or Cow-pox. London, 1799. 4to.

Ibid., A Continuation of Facts and Observations relative to the Variolæ Vaccinæ, or Cow-pox. London, 1800. 4to.

Bryce, James, Practical Observations on the Inoculation of Cow-pox, pointing out a new Mode of obtaining and preserving the Infection, &c. Edinburgh, 1809. 8vo.

Woodville, William, M.D., Reports of a Series of Inoculations for the Variolæ Vaccinæ; with Remarks, &c. London, 1799. 8vo.

Creaser, Thomas, M.D., Evidences of the Utility of Vaccine Inoculation. Bath, 1801.

Gregory, George, M.D., Lectures on the Eruptive Fevers. London, 1843. 8vo.

2647. *Vaccination* consists in the insertion of cow-pox matter under the skin, whereby a peculiar diseased process is set up, which destroys or diminishes the susceptibility to the contagion of small-pox. The vaccination is performed either with fresh cow-pox matter, conveyed from one individual to another, or with dry matter which has been previously moistened. Other modes of vaccination are inadmissible, and the former is the best, as it is also at present the most common.

Cow-pox matter comes originally from the pustules on the teats of cows in various countries (1). The matter to be used, must be obtained from an uninjured pellucid pustule, between the sixth and ninth day, and be clear and transparent. If dry matter be used, it should have been taken under the just-mentioned circumstances, and should have been kept safe against the effect of both light and air. To effect this, various modes have been advised, as placing between glass plates hermetically sealed, on threads of lint or cotton, on golden or bone needles, in glass tubes, and so on (2).

[(1) "The earliest notice I have ever seen," says **Gregory**, "of cow-pox, is to be found in a weekly paper published at Göttingen, in 1769, where we learn that such a complaint was not uncommon in the neighbourhood of that town, and that those who caught it from the cows flattered themselves they were secure from the infection of small-pox. A notion of the same kind had long prevailed in Gloucestershire, a great dairy country, and had often been forced on the attention of the provincial surgeons. But no one thought seriously of this rural tradition, or dreamt of applying it to the general benefit of mankind, until **Jenner** arose. (p. 184.) It was not until the year 1796 that **Jenner** began to experiment with cow-pox, although he had been talking and inquiring about it for at least thirty years. The decisive experiment was made on the 17*th May*, 1796, on a boy, eight years of age. He was tested with small-pox on the 1*st July* of that year, and found to be unsusceptible." (p. 187.) In June, 1798, **Jenner** published his paper, *An Inquiry into the Causes and Effects of the Variolæ Vaccinæ, &c.*; and "it redounds to the honour of St Thomas's Hospital," says **Gregory**, "that its officers were the first persons in England to put **Jenner**'s discovery to the test. Mr. **Cline** vaccinated a boy here in the last week of July, 1798, with dried lymph, which had been kept three months in a quill. The boy had diseased hip, and Mr. **Cline** proposing to convert the vaccine pock into a pea issue, inserted the matter on the outside of the hip. Dr. **Lister**, formerly physician of the Small-Pox Hospital, (and also of St. Thomas's,) watched the progress of the case. The boy was inoculated, almost immediately afterwards, with small-pox in three places, but the slight inflammation that arose subsided on the fourth day. The experiment, therefore, was perfectly successful." (p. 187.)

(2) According to **Gregory**, "vaccine *virus* may be preserved fluid and effective for two or three days in small bottles with projecting ground stoppers, fitted to retain the matter. It may be preserved for a like time in small capillary tubes, having a central bulb. This is the mode used in France for the transmission of vaccine lymph to the provinces, and which proves very effectual; but if you attempt in this manner to transmit lymph to the East or West Indies, you will fail utterly. Ivory points, when well armed and carefully dried, are very effective. They will retain their activity in this climate for many months, and they are found to be the most certain mode of sending lymph to our colonies. Some practitioners prefer glasses to points, but they are less certain. The employment of scabs for the propagation of cow-pox was first recommended by Mr. **Bryce**, of Edinburgh, in 1802. It is a very excellent mode of transmitting vaccine matter to distant countries, but some nicety is required in operating with scabs, which experience alone can teach." (pp. 198, 99.)

As regards the period at which lymph should be taken for vaccination, **Gregory** says:—"The younger the lymph is, the greater is its intensity. The lymph of a fifth-day vesicle, when it can be obtained, never fails. It is, however, equally powerful up to the eighth day, at which time it is also most abundant. After the formation of *areola*, the true specific matter of cow-pox becomes mixed with variable proportions of *serum*, the result of common inflammation, and diluted lymph is always less efficacious than the concentrated *virus*. After the tenth day the lymph becomes mucilaginous and scarcely fluid, in which state it is not at all to be depended on. * * * Infantile lymph is more to be depended on than the lymph obtained from adults. The matter of primary vaccinations is more energetic than that of secondary vaccinations." (pp. 195, 96.)]

2648. Vaccination is a completely dangerless operation, which may be performed at any time of year and in any age. It seems, however, most suitable, unless there be prevailing small-pox, to perform it in the second half of the child's first year, in spring, summer, or autumn, when the child's health is undisturbed.

2649. If vaccination be performed from a fresh pustule, the child must be placed on the lap of a sitting person. The point of a lancet is to be introduced into such pustule, as above described, of a person near at hand, so as to bring away some of the clear matter upon it without drawing blood. The child's upper-arm is then grasped, the skin drawn tight, and the charged lancet thrust in obliquely, about a line beneath the *epidermis*, which must be gently lifted, the point of the lancet moved a little backwards and forwards, and the left thumb being placed on its point, the lancet is then laid flat, and drawn out. In this way, three insertions of matter are to be made on each arm. Dressing is unnecessary. If the wound bleed, it must be left to dry, and not be wiped off.

[For the proper performance of vaccination, **Gregory** says:—"Let the lancet be exceedingly sharp. It should penetrate the *corion* to a considerable depth. The notion that the subsequent effusion of blood will wash out the *virus*, and thus defeat our intention, is quite imaginary and groundless. Provided that a genuine lymph of due intensity has once come in contact with the absorbing surface of the *cutis vera*, the rest is immaterial. The vessels of the part have received the specific stimulus, and nothing can prevent the advance of the disorder, but some constitutional cause. In making the incision, the skin should be held perfectly tense between the forefinger and thumb of the left hand. The lancet should be held in a slanting position, and the incision made from above downwards. * * * I would recommend that, with lymph of ordinary intensity, five vesicles should be raised, and that these should be at such distances from each other as not to become confluent in their advance to maturation." (pp. 197, 98.)]

2650. If vaccination be performed with dry matter, it must be moistened with pure water, so that a part of it may be got upon the lancet-point. In other respects, the proceeding is precisely the same as in the former mode.

2651. The appearances which ensue after vaccination, if it be effectual, are the following:—

On the first and second day only a trace of the slight stab is observed. On the third day a blush appears at the place of vaccination, which becomes more distinct on the fourth and fifth days, and in its middle a little hard knob rises, which increases and is surrounded with a reddish *areola*. On the sixth day the colour of the knob becomes reddish white, it contains some fluid, presents a pit in its centre, surrounded with a swollen edge; the hardness is felt as deep beneath the skin as it is elevated above it; the red *areola* becomes more considerable. On the seventh day the vesicle distinctly contains a transparent fluid, and the other appearances are more decided. On the eighth day the vesicle has attained the size of a lentil; it is still most commonly filled with clear fluid, and surrounded with a more or less extensive *areola*. On the ninth day this *areola* is larger. On the tenth day the vesicle has become a pustule, in which the contained fluid becomes untransparent, thick, and converted into pus, and the pit in its middle disappears. On the eleventh and twelfth day the red *areola* diminishes, the pustule begins to dry, is converted into a dusky-brown, blackish, thick and tough scab, which falls off about the four-and-twentieth day, leaving a flat scar (1). With these local symptoms, there occur, on the seventh, or more commonly on the eighth day, a slight attack of fever, in which, however, but few children lose their appetite and their usual liveliness. At this period, if the *areola* be very much inflamed, there is often pain and swelling of the axillary glands (2).

[(1) To the above account may be added from GREGORY, that, "by aid of the microscope, the efflorescence surrounding the inflamed point will be distinctly perceived, even on the second day. On the fifth day the cuticle is elevated into a pearl-coloured vesicle, containing a thin and perfectly transparent fluid in minute quantity. The shape of the vesicle is circular or oval according to the mode of making the incision. On the eighth day the vesicle is in its greatest perfection, its margin is tinged and sensibly elevated above the surrounding skin. In colour the vesicle may be yellowish or pearly. The quantity of fluid which it contains. will be found to vary much. When closely examined, the vesicle will exhibit a cellulated structure. The cells are eight or ten in number, by the flow of which the specific matter is secreted. The vesicle possesses the umbilicated form belonging to *variola*. * * * On the eleventh day the *areola* begins to fade, leaving in its decline, two or three concentric circles of a bluish tinge. Its contents now become opaque, the vesicle itself begins to dry up, and a scab forms, of a circular shape, and a brown or mahogany colour. By degrees, this hardens, and blackens, and at length between the eighteenth and twenty-first day, drops off, leaving behind it a cicatrix of a form and size proportioned to the prior inflammation. *A perfect vaccine scar should be of small size, circular, and marked with radiations and indentations.* These show the character of the primary inflammation, and attest that it had not proceeded beyond the desirable degree of intensity. Many of the most perfect scars disappear entirely as life advances (pp. 189, 190.)

(2) "Until the eighth day," continues GREGORY, "the constitution seldom sympathizes. At that period, however, it is usual to find the infant somewhat restless and uneasy. The bowels are disordered. The skin is hot, and the night's rest is disturbed. These evidences of constitutional sympathy continue for two or three days. There is, however, much variety observable here. Some children suffer slightly in their general health throughout the whole course of vaccination. Others exhibit scarce any indication of fever, although the *areola* be extensive, and the formation of lymph abundant." (pp. 190, 91.)]

2652. The above named symptoms sometimes occur according to this order, only about two days later, but without interfering with the effect of the vaccination. But if the course of the vaccine vesicle be irregular, if it be formed on the first or second day, if it show no pit in its middle, if its contents be not clear and transparent, but yellow and purulent; further, if the inflammation spread more widely, if the hardness on the circumference of the pock be wanting; if the vaccination spot be from the very first converted into an ulcer, or a mere slough; if instead of a dusky-brown or blackish scab, a yellowish-green, loose scab be formed; if the febrile symptoms be entirely absent, or do not appear at the proper time, the vaccination must be considered as a failure, and the security from it of no value. The cause may rest on vaccinating with bad matter, if it be not clear, or if the lymph employed be putrid, if it be inserted too deeply, or if it be inserted with a blister-plaster.

[On this point GREGORY remarks:—"Occasionally we meet with persons who, from some peculiarity of habit, are wholly insensible to the vaccine poison, in whatever intensity, and by whatever mode it is applied. They receive it as they would so much cold water. The proportion of mankind who exhibit this idiosyncrasy is very small. I may have seen thirty or forty such cases in the course of my life. It would be very interesting to determine whether this constitutional inaptitude to cow-pox denotes a like inaptitude to receive and develop the variolous poison. In the few cases which I have seen, where inoculation was subsequently tried, the insusceptibility was proved to extend to both poisons; but I have read of instances of an opposite kind. * * * The insusceptibility to the vaccine poison is, in some cases, obviously dependent on constitutional weakness, displayed in the slowness of dentition, the imperfect ossification of the head, and the emaciated aspect of the body. There exists here an atony of the absorbent system." (pp. 188, 189.)]

2653. The after-treatment of vaccination simply requires proper regulation of the health. Care must be taken that the child do not touch or scratch the pock. In severe inflammation cold applications must be made; and if much fever, proper diet must be directed. If there be much suppuration at the vaccination spot, lead wash must be applied. Eruptions of the skin, which sometimes occur after vaccination, either subside of themselves under proper treatment, or by the use of slightly-diaphoretic remedies (1). If the vaccination fail, it must after some time be repeated.

If vaccination with the lancet fail repeatedly, it must be performed with a thread soaked in the cow-pox matter, after previously moistening it with warm water, and inserted into a slight cut in the upper-arm, over which a piece of linen, spread with cerate, is to be placed, and fastened with a bandage, because this mode of vaccination is certainly successful.

[(1) "It is not uncommon," says GREGORY, "to find the child's body covered, generally or partially, with a papulous eruption, of a lichenous character, from the ninth to the twelfth day, or even later. It is seldom seen in adult vaccination; but is frequent in children full of blood, in whom numerous vesicles had been raised, which discharged freely. *Vaccine lichen*, as this eruption is properly called, often occasions great anxiety in the mind of the parent, from a suspicion that small-pox is coming out. I have seen it in such intensity as to be followed by minute vesicles: but this latter appearance is very rare. It is an accidental occurrence, chiefly attributable to the peculiar delicacy of the child's skin and fulness of habit. Like the constitutional irritative fever, it indicates that the disease has taken effect on the system; but it is not deemed essential to the success of the process." (p. 191.)]

VI.—OF INFUSION AND TRANSFUSION.

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MAJOR, Chirurgia Infusoria. Kilon. 1767.

ETTMÜLLER, De Chirurgiâ Transfusoriâ. Lipsiæ, 1697.

HEMMANN, Geschichte der Infusion, und Versuch, die sichere Anwendung dieser Operation zur erweisen; in Med.-Chirurg. Aufsätze, p. 122. Berlin, 1778.

Scheel, Die Transfusion des Blutes und Einspritzung der Arzneien in die Adern, historisch und in Rüchsicht auf die Heilkunde. Kopenhagen, 1802–1803.

Hufeland, E., De Usu Transfusionis Sanguinis, præcipuè in Asphyxiâ. Berol., 1815.

Graefe, Dissert. de Novâ Infusionis Methodo. Berol., 1817.

de Boer, Dissert. de Transfusione Sanguinis. Gröning., 1817.

Percy et **Laurent**, Article *Infusion*; in Dict. des Sciences Médic., vol. lxxv.

Blundell, James, M.D., Experiments on the Transfusion of Blood by the Syringe; in Medic.-Chir. Trans., vol. ix. p. 56. 1818.

Ibid., Physiological and Pathological Researches. London, 1825. 8vo.

Tietzel, Dissert. de Transfusione Sanguinis. Berol., 1824.

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Heyken, Dissert. de Transfusione et Infusione. Rostoch, 1830.

Blasius, Klinisch-chirurgische Bemerkungen, p. 123. Halle, 1832.

Marcinkowsky; in Hamburger Zeitschrifte, vol. i. part iii.

Berg; in Würtemberger Correspondenzblatt. 1838, Jan.

Giesler; in **Holscher's** Annalen, vol. ii. part ii.

Berthold; in same, vol. iii. part iv.

2654. *Infusion* consists in opening a vein, through which opening the pipe of a syringe may be introduced upwards, some medicated fluid injected, and the wound of the vein afterwards treated in the same way as that made in bloodletting. This operation, which in the latter half of the seventeenth century attracted great attention, was especially employed in those cases where no medicine could be taken by the mouth. It has been sometimes used successfully when foreign bodies had stuck in the throat, (*par.* 1731,) as well also as in cases of seeming death.

Infusion, mentioned by **Magnus Pegelius** and **Libavius** in 1615; and practised on a dog by a Captain G. **von Wahrendorff** in 1642; was first subjected by **Ch. Wren**, who first performed it on a malefactor, in 1656, to philosophical examination. The English Physicians, **Clark**, **Lower**, and others, made experiments with it upon brutes; **Major** in 1664, and **Elsholz** in 1665, first employed it on men; **Schmidt**, **Purmann**, and P. **Sarpi**, especially occupied themselves with it. However, it soon sank in the estimation of physicians, and has only of later years been employed in a few cases in Germany by **Köhler**, **Hemran**, **Meckel**, and others. After the early cases and his own experiments upon this subject had been collected by **Scheel**, the operation was performed in Germany by **Graefe** and **Horn**, and by **Laurent** and **Percy** in France, on men. **Bichat**, **Nysten**, **Seiler**, **Magendie**, **Orfila**, and **Dieffenbach**, instituted some exceedingly interesting, and for physiology, important experiments upon the injection of different kinds of matters into brutes, and have employed this operation on man, as for instance in *tetanus* and *cholera*. The most complete account of infusion and transfusion is given by **Scheel** and by **Dieffenbach**.

The effect of the injection of any matter into the veins is different according to its nature and the nature of the disease. The usual effects which all injections produce, besides those peculiar to them, are, sweating, frequent vomiting, shuddering of the whole body, and sometimes fever. All the remedies to be injected must be dissolved in water and be only as warm as the blood. In stubborn nervous diseases epilepsy, affections of the mind, *hysteria*, *tetanus* and *trismus*, in dyscrasic diseases, *syphilis*, gout, obstinate diseases of the skin, in typhus and intermittent fevers, infusion has been tried, and very different remedies have been injected. Narcotic remedies, as *belladonna*, *opium*, *hyoscyamus*, *digitalis*, *nux vomica*, strychnine, *stramonium* have generally dared only to be given in two-thirds of their ordinary dose; salt is borne in large quantity; they have the same effect as if taken into the stomach, though their operation is mostly very irregular. Simple warm water, which **Magendie** has injected in *hydrophobia* to the amount of two pints, by which quietude though not cure has been effected, produces great faintness, violent sweating, and increased secretion of urine; sometimes when much is injected, watery stools; and if it be thrown in cold, severe shivering with dry cough, pale urine, faintness, and severe sweating. In *tetanus* **Percy**, **Laurent** and **Onsenoort** have found good results from injecting *extr. opii* and *extr. daturæ stramonii.* In *cholera* **Latte** injected a solution of salt, consisting of two to three drams of nitre and two scruples of carbonate of potash to six pints of distilled water, at a temperature of 112° Fahrenheit, to the amount of six or eight pints at once, and repeated it, so that from fifteen to forty-four pints were thrown in. In Germany this was tried by **Zimmermann**, **Casper**, **Blasius** and others, but it produced only a passing effect. In cases of foreign bodies in the throat, **Köhler**, **Balk**, **Kraus** and **Graefe** have employed with advantage an injection of a solution of two to six grains of tartarized antimony, in half an ounce to an ounce and a half of distilled water, with the result already mentioned (*par.* 1731); and **Meckel** has also used it in a case of seeming death.

2655. For injection, a very small vein should not be chosen, the *vena cephalica* is best. After the arm has been properly fixed, a fold of skin is to be made over the vein, and cut through lengthways from an inch and a half to two inches in the course of the vein; the vein is to be separated from the cellular tissue and two threads carried round it; after which it is to be lifted a little up and opened lengthways with the lancet, to an extent corresponding with the size of the pipe. After having filled the pipe with warm water, it must be passed in towards the heart, the threads tied firmly around it so that the blood shall not escape, and then it is to be held by an assistant. The syringe heated by dipping in warm water to the temperature of the blood is now filled with the fluid warmed to the same degree, and its point being directed upwards, some of the fluid is squirted out, so that all air may be got rid of; it is then introduced into the pipe, and the fluid slowly and at intervals injected into the vein. If more fluid have to be thrown in, the syringe must be removed, the opening of the pipe covered with the finger, and the injection repeated as before. When the injection has been completed, the threads are to be removed, the pipe carefully withdrawn from the vein, and the wound compressed with the thumb and finger of the left hand. The wound in the skin is to be brought together with slips of sticking plaster, over which a little compress and a bandage are to be applied, as after bloodletting. To prevent inflammation cold applications are to be made for some days.

The practice of opening the vein after putting on a bandage, as in bloodletting, and injecting after the removal of the bandage is improper, as the injection may go into the cellular tissue. According to **Blasius**, the vein should be laid bare by a cut upon the skin, compressed at the upper part of the wound, opened in its longitudinal axis with a lancet, and into this aperture the little tube immediately inserted. For the injection he employs a tube with a pig's bladder; **Scheel** uses a syringe with an elastic tube; others an Indian rubber bottle, **Helper**'s funnel of transparent horn; **Hager** uses a glass blowpipe with a silver syringe; **Graefe** opened the vein with a thin curved trocar which he thrust into the swollen vein, drew out the stilette, allowed an ounce of blood to escape from the canula, and into it introduced a closely-fitting syringe, with which he injected the fluid.

2656. *Transfusion* consists in opening a vein, into which blood is conveyed from the artery or vein of another person, (*immediate transfusion*,) or by means of a syringe (*mediate transfusion*, *infusory transfusion*.) The history of this operation is connected with that of infusion. The notion of improving the juices, and of curing cachectic and dyscrasic diseases by the transfusion of the blood of man or brutes, which was very prevalent in the latter half of the seventeenth century, has not been confirmed by experience. The operation was nearly forgotten, and only in modern times has been brought into use successfully in cases of loss of blood, especially after childbirth, and also in continued and irremediable vomiting, where death from inanition was dreaded (**Blundell**). Only in such cases can its employment be advantageous, as even in *cholera*, its use has been without any beneficial result.

Although M. **Pegelius** and **Paola Salvi** are named as the discoverers of transfusion **Libavius**, and afterwards **Colle**, noticed it, yet it was first performed in France by **Denis** and **Emmerez** in 1667, and by **King** afterwards in England on man; in Germany by **Kauffmann** and **Purmann**. Notwithstanding the predilection of many practitioners for this operation, its results were not such as to keep it in sight. **Rosa** first repeated it in 1783; **Scheel** in 1802 collected the experiments already made in recent times. **Blundell** has successfully performed this operation in cases of loss of blood, and proposed it in vomiting which could not be stopped, and the inanition to be feared therefrom. Hence are the English practitioners decided on its employment, and it has consequently been practised by **Doubleday**, **Uwins**, **Waller**, **Knox**, and others. **Prevost** and **Dumas**, as well as **Dieffenbach**, have made experiments interesting in a physiological view, and the latter has employed it, though without advantage, in *cholera*. **Graefe** has modified the apparatus for immediate transfusion.

2657. Although immediate transfusion has the important advantage, that the blood not being changed by the influence of the air, its natural warmth is preserved, that it does not coagulate, and is even propelled by the action of the heart; yet, however, in recent times, mediate transfusion has been preferred, because, in immediate transfusion by tubes, the blood always clots in a few seconds, whereby its passage is prevented, and generally, it is not known what quantity of blood has passed; because, further, the passage of blood from one vein to another is impossible, as the stream of venous blood has not sufficient power, the opening of a small artery is insufficient, that of a larger one not admissible in men, venous blood is, generally, more proper, and human blood more suitable than that of beasts.

Various apparatus have been proposed for immediate transfusion. **Denis** used two small silver tubes, curved at one end, and furnished with a shoulder, and at the opposite end, received into each other; he introduced the shouldered end of a tube into the artery of a beast, and that of the other into the patient's vein, and then connected both by inserting their free ends. **Boehm** connected them with a small piece of intestine, as for instance, that of a fowl, by stroking which, the passage of the blood might be encouraged. Instead of intestine, **Regner de Graaf** connected the two tubes with a piece of artery dissected from a beast, to which there was a side branch, partly to allow the escape of the air, and partly to note the constant stream of the outflowing blood. **von Graefe**'s apparatus consists of a glass cylinder filled with warm water at a temperature of 29° Réaum., (97° Fahr.,) and furnished with a cock for the escape and renewal of the water, and through which a glass tube passed for carrying the blood, which received at one end another tube, of which that for the artery was curved and shouldered, and that for the other, elastic.

In the performance of immediate transfusion, the beast, properly bound, is placed on a table near the patient, one of whose veins is opened, and a tube passed into it towards the heart; this is given to an assistant, and below the wound a compressing bandage is applied. The carotid or crural artery, according to the size of the beast, is then laid bare, a ligature passed around, and a director pressed upon it, and beneath the pressed part the vessel is opened lengthways with a lancet. Into this opening the end of one tube is inserted, and the artery fastened around it with a ligature; the other end is inserted into the tube ensheathed in the vein, after the pressure has been removed from the artery, and a little blood allowed to escape. When the operation is finished the apparatus is withdrawn, and the wound closed, as in bloodletting.

2658. What has been already said (*par.* 2654) in reference to the possible danger of infusion, applies also to transfusion. If too much blood be injected at once, and too quickly, overfilling and rending of the heart, palsy, and death, may ensue. **Magendie** has also observed that not merely the entrance of air into the vein, but also of clotted blood, may cause death by stopping up the minute vessels of the lungs. According to Bickersteth (*a*), transfusion should, where possible, be undertaken before the circulation in the patient's arm has entirely ceased.

2659. The following is the mode of proceeding in mediate transfusion. A sufficiently large superficial vein, the *vena cephalica* is best, must be laid bare, by a cut an inch and a half long, upon a fold of skin; the vein is to be cleared from the cellular tissue, and two threads carried round it, of which the one corresponds to the upper, and the other to the lower angle of the wound. The threads are now to be tied, and whilst with them the vessel is a little raised, it is opened with the lancet. The canula filled with warm water, is now passed into the vein, and the upper thread tied over it, the lower thread remaining tied. Whilst this is doing, the person from whom the blood is to be taken, standing close to the patient, has a vein opened with a large wound, the blood is received into a warm vessel, and the syringe, also warmed, draws up of it about two ounces. The point of the syringe is now quickly directed upwards, a little blood squirted out to get rid of the air, and it is then fixed into the canula in the vein, and the blood slowly injected through it. The syringe should not be completely emptied, because the remaining blood in it quickly clots. The syringe is now to be cleared with warm water, and the injection repeated, for which purpose the vein, which in the mean while has been compressed, must now be reopened, and blood drawn into a cup as already mentioned. After the lapse of five minutes, more blood may be thrown in according to circumstances. The dressing and after-treatment are to be managed exactly as in infusion. (*par.* 2635.)

Blundell's apparatus consists of a funnel for receiving the blood, connected by a tube with the syringe which injects the blood into the vein through an elastic tube. It is not proper, because the blood easily clots in it.

Instead of a syringe holding two ounces, Blasius thinks a smaller one holding not more than half an ounce, is better, as therewith the blood loses less of its vitality, and clots less.

John Müller proposes, after separating the fibrous parts from the blood by beating, to inject it warmed, as in this way it still retains its corpuscles and living powers.

VII.—OF CAUTERIZATION.

Costæus, De Igneis Medicinæ Præsidiis. Venet., 1593.

Fienus, De Cauteriis. Leovan, 1598.

Severinus, Pyrotechnia Chirurgica; in his De Efficaci Medicinæ, p. 143. Francof., 1646.

Recueil des Pièces, qui ont concouru pour le prix de l'Académie de Chirurgie, vol. iii.

Pouteau, Mémoire sur les Avantages du Cautère Actuel; in his Mélanges de Chirurgie, p. 1.

Loder, Ueber das künstliche Brennen; in his Medic.-Chirurg. Beobachtungen, vol. i. p. 230.

Pascal, Ueber die Wirkungen des Brennens mit Moxa; in neuster Sammlung der bester Abhandlungen für Wundärzte, vol. ii. p. 302.

Percy, Pyrotechnie Chirurgicale Pratique. Paris, 1810.

Valentin, L., Mémoire et Observations concernant les bons effets du Cautère Actuel. Nancy, 1815.

Larrey, De l'Usage de Moxa; in Recueil de Mémoires de Chirurgie, p. 1. Paris, 1821.

(*a*) Liverpool Medical Journal. 1834. May.—London Medical Gazette, vol. xiv. p. 599.

Baerwinkel, Dissert. de Igniis in Arte Medicinâ. Lipsiæ, 1824.

Klein, Ueber die Anwendung des glühenden Eisens; in von **Graefe** und von **Walther**'s Journal, vol. iii. part iv. p. 605.

Wolff; in same, vol. v. part. iii.

von **Kern**, V., Ueber die Anwendung des Glüheisens bei verschiedenen Krankheiten. Wien, 1828.

2660. Under the term *Cauterization*, is included the more or less severe application of *escharotics* or of *fire* on any part of our body. Escharotics, (*Cauteria potentialis*, Lat.; *Aetzmittel*, Germ.; *Caustique*, Fr.,) of which those most in use are lunar caustic, caustic potash, Cosme's powder, corrosive sublimate and butyr of antimony, are applied either in a dry form, or as powder made into a paste with a little fluid, or in a fluid form, the mode of using which on luxuriant granulations has been already noticed (*par.* 2352, and frequently elsewhere.) *Fire* (*Ignis*, Lat.; *Feuer*, Germ.; *Feu*, Fr.) is applied either with the actual cautery (*Cauterium actuale*) or by combustible substances, (*Moxa*, Lat.; *Brenncylinder*, Germ.,) which are allowed to burn on the surface of the body.

2661. The object of cauterization is generally very various, and may be, *first*, the destruction of a part; *second*, alteration, change, or excitement of the living activity of any one part, whereby a more speedy conversion of its substance, a more active absorption and the dispersion of tumours is effected; *third*, a greater degree of inflammation; *fourth*, removal of a deep-seated process of disease to the surface of the body; *fifth*, destruction of hurtful matter; *sixth*, stoppage of bleeding, especially that of the so-called parenchymatous. In consequence of these various effects of cauterization it is employed in a great many diseases, for instance, in fungous growths, in cancer, moist and secreting parts, in teleangiectasy, in cold abscesses, in deep-seated, rheumatic and gouty affections, in the several diseases of joints, in palsy and other nervous affections, in deep-seated suppuration and the like.

2662. It must be remarked, in reference to the effect of cauterization by escharotics and by fire, that the former always causes destruction of the part on which it is applied, but little alters the vitality of the neighbouring parts, and is only specially effective from the suppuration set up in the cauterized part. Hence its use, if the destruction of the part be not the object of its application, is specially confined to those parts where a discharge is to be kept up for a long time. The operation of fire acts more deeply upon the neighbouring parts, sets up greater reaction, excitement of the living activity, quicker change of substance, violent contraction of muscles, and independent of those cases where its object is the destruction of any part or the formation of a slough, may be considered in many other cases as a powerful remedy for the purpose, after the separation of the slough formed by the burn, of keeping up long-continued suppuration.

2663. The *Actual Cautery* may be employed at various degrees of heat; it may either be held at a distance of five or six inches, and brought gradually nearer and nearer to a part, or it may be moved freely upon the surface of a part, or it may be kept in contact with it for some time. According to these degrees in the application of the actual cautery do its effects vary, and in the latter case is it very effectual and exciting.

2664. Of the various forms of *cautery irons* the following are most useful, and if of different size answer all purposes, *α*. conical, *β*. flat round, γ. prismatic or hatchet-shaped. The conical iron is specially used where one particular small part is to be acted on, for instance in bleedings; the round, where the effect is to be greater and a permanent issue is to be formed; the prismatic or hatchet shaped, for quickly passing over any part. If the actual cautery be used in any one cavity, or without subjecting the neighbouring parts to the effect of the fire, either a conical iron with a sheath must be employed or a red-hot trocar, which is to be carried to the part required in its own sheath.

2665. When the actual cautery is made use of, special care must be taken that the patient be held fast; and the part to which it is applied must be carefully dried, and if hairy the hairs must be removed. The iron should be white-hot. When the object is to destroy a part, to stanch a bleeding, or to form an issue, it must be applied efficiently and pressed down with requisite force. If the iron cool and the object be yet unattained, a second white-hot iron must be applied. If the cautery be applied in stripes, the stripes should be first marked, should not go from the same point, should not cross, should be an inch and a half to three inches asunder, and the white-hot prismatic or hatchet-shaped iron should be carried in the direction of these stripes with due care over the skin, because it very easily slips from the proper direction. **Klein**'s double cautery iron much facilitates this operation.

The parts to be avoided in applying either the actual cautery or the moxa, are the skull, where covered only by the *pericranium* and skin, at least the cautery must not be applied here above a couple of seconds, otherwise its effect will be propagated to the membranes of the brain and the brain itself, the ridge of the nose, the eyelids, the course of the *larynx* and windpipe, the breast-bone, the breast-glands, the white line of the belly, the superficial tendons, the generative organs, and those parts of joints where, on account of the superficial situation of the capsular ligament, injury to it may be dreaded (*a*).

2666. After the actual cautery has been applied, the part must be covered with lint, dry and spread with some simple ointment. If the pain following be very severe, it may be relieved with anodyne applications. The patient must be kept quiet, and according to circumstances, take antiphlogistic or narcotic medicines. When the slough separates, the suppurating part must be dressed with ointment which will promote its healing, or the suppuration must be kept up as the case requires. If the cauterization have been made on account of bleeding, the early dropping off of the slough must be carefully avoided.

2667. The *Moxa* is a cylinder of cotton held together with a linen bandage and a few stitches, about an inch high, and of larger or smaller extent, according to the condition of the part to which it is to be applied, and the effect it should produce. The cotton must not be too tightly compressed, and the part on which the moxa is placed must be quite flat. To fix the moxa, a moxa-holder (*b*) is best employed, to wit, a metallic ring with wooden feet and handle. The neighbouring part where the moxa is applied must be covered with moist compresses to protect them from the sparks which fly about, as when lighted it must be blown with a pipe so as to keep it properly burning; but if its effect be not required to be violent, it may be left to burn without blowing.

A special and very convenient kind of moxa may be made with rotten phosphorescent wood, properly dried and powdered, and mixed up into a paste with alcohol which being forced into a mould, may be formed into a cylinder as thick as a quill

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(*a*) **Larrey**, above cited, p. 6, pl. xi. fig. 1, 2.

(*b*) **Larrey**, above cited, pl. i. fig. 3, 4.

this when dry may be cut into pieces half an inch long; the end of each must be smeared with some digestive ointment to stick it to the skin, and its upper end must be lighted. It burns without any blowing, and its small size permits its application at any part and in any quantity (LARREY.)

According to PERCY, moxas are best made from the pith of the sunflower (*Helianthus annuus*) rolled up in cotton, soaked in a solution of saltpetre, or in alternate layers of soft tow or fine cotton, which have been some time soaked in a solution of saltpetre, two drams to a pint of water. Both kinds of moxa have the advantage, like the former, of burning without blowing (*a*).

Very useful moxas are made of firm English blotting-paper, repeatedly dipped in a solution of chromate of potash, one part to fifteen parts of water, and dried. A piece of this paper is to be rolled up, and kept together by a needle thrust through it. It burns quickly and regularly.

If the part burnt with a moxa be touched with caustic ammonia, the slough is not thrown off by suppuration, but gradually scales off (LARREY.)

2668. The slough thus formed is to be covered either with folds of soft linen, or if its separation and the formation of an issue be required, with a pledget spread with digestive ointment; in the latter case, after the slough has been thrown off, the suppuration is kept up, either by frequently touching with caustic, or by inserting a pea, which is first to be fixed with sticking plaster and a bandage, till it form itself a pit.

2669. The difference between the effect of a moxa and of the actual cautery is, that in the former, the sensation of a certain warmth is gradually increased to a violent degree of pain; hence it extends its operation to the deeper tissues, and consequently is to be preferred in affections of deep-seated organs, to the actual cautery. LARREY (*b*) also supposes that the moxa, besides its relative quantity of heat, communicates to the neighbouring parts a volatile, very active principle, which is produced by the burning of the cotton (*c*).

VIII.—OF THE DIVISION OF NERVES IN NEURALGIA.

HAIGHTON, JOHN, M.D., A case of Tic Douloureux, or painful affection of the Face, successfully treated by a division of the affected (infraorbitar) nerve; in Medical Records and Researches, p. 19. London, 1798. 8vo.

LANGENBECK, Tractatus Anatomico-Chirurgicus de Nervis Cerebri in dolore Faciei consideratis. Götting., 1805.

KLEIN, Ueber die Durchschneidung der Nerven bei dem Gesichtsschmerze; in VON SIEBOLD'S Chiron, vol. ii. part ii.

LEYDIG, Doloris Faciei dissecto Nervo infraorbitali profligati Historia. Heidelb., 1807.

VAN WY, Von der Durchschneidung des unteren Augenhöhlennerven; in Sammlung auserlesener Abhandlungen für praktische Aerzte, vol. iii. p. 463.

ABERNETHY, JOHN, On the Tic Douloureux; in his Surgical Works, vol. ii. p. 203. Edition of 1815.

MURRAY, Essay on Neuralgia. New York, 1816.

KLEIN, Ueber die Möglichkeit der Zerstörung der Gesichtsnerven bei seinem Austritte aus dem Schädel; in VON GRAEFE und VON WALTHER'S Journal, vol. iii. p. 46.

EGGERT, Ueber das Wesen des Gesichtsschmerzes und die Operation desselben; in same, vol. vii. part iv. p. 538.

BONNET, Traité des Sections tendineuses et musculaires, etc.; suivi d'un Mémoire sur la Neurotomie souscutanée, p. 622. Paris et Lyons, 1841.

MAYO, HERBERT, Outlines of Human Pathology. London, 1836. 8vo.

(*a*) VON GRAEFE und VON WALTHER'S Journal, vol. iii. p. 491.

(*b*) Above cited, p 7.

(*c*) BOYLE, J., Treatise on a modified application of Moxa in the Treatment of Stiff and Contracted Joints, and also in Chronic Rheumatism, Rheumatic Gout, Lumbago, Sciatica, Indolent Tumours, &c. London, 1826. Second Edition.—WALLACE, WILLIAM, M.D., A Physiological Enquiry respecting the action of Moxa, &c. Dublin, 1827.

2670. In stubborn neuralgies, which withstand all internal and external treatment, specially those which are seated in the branches of the nerves of the face, the division of the trunk is the only remaining remedy. The result of this operation is generally doubtful, as, although momentary relief from pain follows it, the disease returns, which is explained by the numerous ramifications of the nerves spreading on the face, but is kept up by the union of the divided nerves, on which account it has been recommended to cut out a piece of the nerve, and to employ cauterization. In recent times, however, the subcutaneous division of nerves has been proposed. (BONNET, DIEFFENBACH, and others.)

2671. In *frontal neuralgy* where the supraorbitar branch of the fifth pair of nerves is affected, the pain begins in the supraorbitar hole, spreads over the forehead, the hairy part of the head, downwards into the orbit, to the inner corner of the eyelids, and frequently over the whole side of the face. The supraorbitar nerve should be cut through transversely, in doing which the soft parts, above the supraorbitar hole, must be divided down to the bone with a bistoury, and lint thrust into the wound, which should heal by suppuration and granulation.

In the *subcutaneous division of the inner and outer branches of the frontal nerve*, the skin should be pierced about an inch from the middle line, and the third of an inch above the eyebrow, wih the tenotome thrust in downwards and outwards, and carried an inch or an inch and a half further beneath the skin; the instrument is then held steady with its cutting edge forward, and the skin pressed several times with the thumb of the other hand, so as to cut through the parts beneath it. To make more sure that the nerve do not escape, the edge of the knife must be turned back so as to divide the soft parts down to the bone. If the inner branch of the nerve have to be divided, the knife after being withdrawn, must again be introduced into the wound, turned inwards and downwards, and the division made in the same way.

2672. In the case of an *infraorbitar neuralgy*, (FOTHERGILL'S (*a*) *Face-ache*,) where the pain begins at the outlet for the infraorbitar nerve, and spreads over the wings of the nose, the cheek and upper lip of one side, the infraorbitar nerve must be divided. This must be done by thrusting a pointed bistoury half an inch below the under edge of the orbit, and half an inch from the inner corner of the eye, directly down towards the cuspid tooth, to the bone, and carried outwards, and downwards three quarters of an inch towards the zygomatic process of the upper jawbone. The wound is to be treated as in the former case.

In the *subcutaneous division of the infraorbitar* nerve, that part of the skin is first chosen which corresponds to the *infraorbitar* hole; about half an inch from which outwards and the same distance below the edge of the orbit, the skin is to be pierced. The upper lip must be drawn downwards and forwards with the left hand, to render the nerve tense and separate it from the cuspid pit. The tenotome with its edge upwards, is introduced with the right hand, and cuts cautiously inwards and a little downwards, that it may sweep the bottom of the cuspid pit, till it reach the *infraorbitar* hole, and stop on the nasal eminence. The edge is now directed a little forwards and divides the nerve by a lever-like movement, the knife being always kept close to the bone.

2673. When the face-ache spreads from the middle of the parotid gland towards the wing of the nose and lower eyelid, towards the corner or the mouth and upper lip, or also even towards the chin, the teeth, and angle of the lower jaw, the middle branches of the infraorbitar and inferior maxillary nerves, or even the lower branches of the facial nerve and the mental nerve are affected.

In the former case, for the *division of the middle branches of the facial*

(*a*) FOTHERGILL, J., M.D., Of a painful Affection of the Face; in Medical Observations and Inquiries, vol. v. p. 129. London, 1776.

nerve and the infraorbitar nerve, Klein makes a cut from about the middle of the nose to the middle of the cheek. In the second case, he makes a cut into the cheek through the *m. masseter* to the under edge of the lower jaw, and beneath it towards its angle. The parotid duct must be avoided. The bleeding from the facial artery must be stanched by thrusting in lint and by a compressing bandage. When the pain extends from the hinder angle of the lower jaw to the upper lip, towards the ear, the nose, and eyelid, when especially the *lower facial nerve* and consecutively the *mental* and *infraorbitar nerves* are affected, a cut should be made for *dividing the facial nerve*, which, according to Klein, should begin below the parotid duct at the edge of the *m. masseter*, pass along the under edge of the lower jaw, and run up to the corner of the mouth. If the inferior maxillary nerve be the seat of the neuralgy, and the pain extend from the second molar tooth over the lower jaw, and the teeth towards the ear and eye, the *inferior maxillary nerve* must be cut through, for which purpose the membrane of the mouth and gums is to be divided, and the knife passed directly from the second molar tooth to the base of the lower jaw, down to the bone. If this be insufficient, the nerve may be divided at its entrance into the maxillary canal, by cutting vertically near the coronoid process, and then, by scarification with a gum-lancet between that process and the *m. pterygoideus* (*a*).

2674. For the *subcutaneous division of the nerves of the cheek*, Dieffenbach passes a tenotome in various directions beneath the skin, and divides the affected nerves with successive strokes. In mental neuralgy, for the subcutaneous division of the nerve, at its escape from the mental hole, the skin covering the lower jaw must, according to Bonnet, be pierced half an inch from the *symphysis*, and the same distance from the lower edge of the horizontal branch of the lower jaw. The tenotome is introduced with the right hand, whilst the lower lip is held with the first three fingers of the left hand, the thumb and middle finger being placed on the outer surface, and the forefinger on the mucous membrane at the first molar tooth, the lower lip drawn forwards and upwards, and the nerve separated a little from the bone. The tenotome, with its edge downwards, is passed backwards and upwards till its point which should run along the bone, and always touch it, reach the first molar tooth, and be felt by the forefinger beneath the mucous membrane. The edge of the tenotome is now pressed down, by raising the handle, and drawn a little back; and this movement is repeated several times, whilst the edge of the knife is carefully kept on the upper surface of the bone. If this operation be performed on the right side, the left hand must be carried round the head of the patient, and the lip held with three fingers, whilst the thumb rests on the inside.

2675. As even the repeated division of the nerves of the face, according to these rules never affords complete relief, and the pain recurs, Klein was first struck with the idea of destroying the trunk of the facial nerve at its exit from the stylo-mastoid hole. After various experiments which he performed on the dead body, for the division of the nerve at the part he had thought of, he performed the operation in the following way. He made a deep penetrating cut with a slightly-curved bistoury, which he thrust in, below the lobe of the auricle, well up-pulled, towards the front

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(*a*) Klein, above cited, in the Chiron.—Lizars, Neuralgia of the Inferior Maxillary Nerve cured by Operation; in Edinburgh Medical and Surgical Journal, vol x ii p. 529. 1821.

edge of the mastoid process, obliquely behind it, to its extremity. The divided occipital artery bled smartly, but was checked by an assistant pressing on the carotid. He then made a transverse cut below the lobe of the auricle, separating it from the beginning of the first cut to the temporal artery, which he avoided, and immediately some trifling auricular branches spouted forth. He then separated the flap in the same way deeply to the hinder edge of the styloid process throughout its whole length, at the same time thrusting the point of the knife deeply upwards and backwards, and lengthening the cut also behind the mastoid process down to the bone. Herewith the facial nerve was cut in two. He now quickly pushed a hot blunt round cautery iron as thick as a common quill, obliquely from below upwards and inwards, pressed it firmly and for some time on the stylo-mastoid hole, and carried it in different directions for the purpose of cauterizing the occipital artery. The wound, which still continued bleeding, was plugged with lint dipped in white of egg and strewed with gum arabic, covered with a compress, the whole fastened with a cloth around the head, and pressure kept up several hours, by an assistant.

2676. No remarkable symptoms occurred after the operation, and the wound healed in a short time. Wryness of the mouth and tip of the nose, which occurred on the destruction of the nerve, subsided, and the face-ache completely ceased. In a second case, which KLEIN operated on, the result was the same, and the patient had no inconvenience beyond a slight mark. In both cases, however, according to positive assurances, the result was not permanent.

KLEIN considers the operation entirely free from danger. If the division of the facial nerve be properly managed, the carotid artery and jugular vein cannot be wounded, as the former lies in its canal too far from the styloid process, and the latter is distant from the place of the cut, and if wounded, can be commanded by pressure (*a*).

According to LANGENBECK, the division of this nerve can be performed with great safety in the following manner. The auricle being drawn upwards and forwards, a cut is made from the front edge of the root of the mastoid process, where it is connected with the styloid process, and continued below the auditory passage, on the front edge of the *m. sterno-mastoideus*, so that its tendinous fibres can be seen. The parotid gland now laid bare is carefully separated and turned aside; and the wounded posterior or occipital artery tied. The finger is now passed to the upper part of the wound, and feeling the junction of the bony auditory passage, and the root of the styloid process as a broad bony surface, is pushed on towards the upper edge of the mastoid process, behind it, but stopping at the hind edge of the styloid process, without reaching its inner side, then from the inner edge of the base of that process and the *m. sterno-mastoideus*, from above downwards, and from without inwards, towards the styloid process, where it tears away the cellular tissue covering the nerve, which then appearing as a white cord above the hinder belly of the *m. digastricus maxillæ inferioris*, is taken hold of with the forceps, lifted up a little and cut through, or a piece of it taken out.

2677. On comparing the subcutaneous division of nerves with the ordinary mode of proceeding, it cannot be denied, that the complete division of the nerve in every case is more difficult, and the nerve may even be missed. This, however, can be avoided by careful performance of the operation, founded on correct anatomical knowledge. The symptoms are usually slight, as in all subcutaneous operations, and the blood which has been thereby extravasated is soon absorbed.

BONNET has attempted to contravert the objection, that the divided

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(*a*) FRIEKER, Dissert. de Secundo Trunco Nervi Duri in Prosopalgia. Tübing., 1813.—KLEIN, above cited.

nerve reunites, by stating, that after its division the extravasated blood remains between the ends of the nerve, and that, afterwards, one part of it is absorbed, and the other becomes organized, and forms a connecting intermediate substance between them. Whether otherwise, by the subcutaneous division of the nerve, the result is rendered more certain, still remains undecided by the experience hitherto had. It must not, however, be overlooked, that several cases which have been related as subcutaneous neuro-myotomies, have produced painful and spasmodic contractions of the muscles (*a*); or it may be doubted whether the trunk of the nerve, or only some little branches of it have been divided (*b*).

The following may be mentioned as examples of the division of nerves, and at different parts. Delpech and Earle have cut directly through the ulnar nerve, where it runs behind the inner condyle. Astley Cooper cut out half an inch of the radial nerve, after laying it bare on the *radius*. Abernethy and Wilson divided, above the injured part, a nerve wounded in bloodletting. Abernethy cut out half an inch of the digital nerve on the middle joint of the finger. Malagodi cut out a semilunar piece, of a finger's breadth, from the ischiatic nerve in the region of the knee-joint. Swan cut through the peroneal nerve, at the inner edge of the outer hamstring; Delpech divided the posterior tibial nerve, whilst on the hinder edge of the shin-bone, laying it and the vessels bare, and separating it from them. Manovy divided the same nerve behind the inner condyle, in a case of traumatic *trismus*. Bujalsky cut off both from the outer branches of both the accesory nerves of Willis, at their exit from the *m. sterno-mastoideus*, a piece three inches long, but without any satisfactory result. In pains in the heel, according to Lentin, deep cuts have been made into the heel, and suppuration kept up in them for a long time. From the energetic application of the actual cautery in plantar neuralgy, I have seen the most satisfactory result.

IX.—OF AMPUTATION OF THE LIMBS.

(*Amputatio Membrorum*, Lat.; *Ablösung der Glieder*, Germ.; *Amputation*, Fr.)

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(*a*) Sperino Casimirino, Neuralgie grave de plusieurs rameaux du plexus cervical, guéri par la Neuro-Myotomie souscutanee; in Gazette Médicale de Paris, vol. ix. p. 205. 1843.

(*b*) Rivieri, above quoted, p. 496.

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2678. *Amputation* is the last and most grievous remedy to which art can have recourse, for the purpose of saving the life of a patient by the loss of a limb. The cases which make it necessary have been already mentioned in treating of gunshot wounds, (*par.* 346,) compound fractures, (*par.* 590,) white swelling, (*par.* 254,) carious ulcers, (*par.* 886,) and elsewhere.

2679. Amputations may be distinguished into those which are performed in the *continuity of the limbs*, (*Amputationes*,) and those *at joints* (*Exarticulationes*.)

2680. The following points must be considered of amputations in general; *first*, the precaution against bleeding; *second*, the formation of such wound that the bone may be properly covered with soft parts; *third*, the sawing off the bone; *fourth*, the stanching the bleeding from the divided vessels; and *fifth*, the proper treatment of the wound formed by the amputation.

2681. *Precaution against bleeding* consists in the compression of the principal artery of the limb to be amputated, either by the application of the *tourniquet*, (*par.* 283,) or by the fingers of an assistant, or with a proper compressor.

The application of the tourniquet is accompanied with many inconveniences, as if it be placed in the neighbourhood of the part where the amputation is to be performed the muscles will not retract properly; it is often inconvenient to the operator, and prevents the return of the blood through the veins. For these reasons compression of the principal artery by a capable assistant, at least in amputation of the upper limbs and thigh, is preferable to the tourniquet. In amputation of the leg the tourniquet is used, because here tying the ligatures is often difficult, and the assistant compressing the vessel becomes exhausted. Compression must always be made at a spot where the artery is superficial, and the neighbouring bone affords a point of support (*par.* 284.)

In patients who are weak and have little blood, BRÜNNINGHAUSEN recommends, that before the operation the limb should be swathed in a flannel bandage nearly up to the place of the cut, in order to diminish the loss of blood.

[The only real advantage derived from the use of a tourniquet at an amputation, except in cases of compound fracture or wounds, where it had been previously applied to check bleeding, is, that the operator has no dread of a gush of arterial blood when he cuts through the large vessels, if he have any doubt of the capability and firmness of the assistant, to whom compression of the principal artery is intrusted. But if he be trustworthy, the compression is more certainly made with the fingers than with the tourniquet, the pad of which, however well adjusted, will often slip from the vessel if the patient struggle, and become quite useless. One would think compression could scarcely be objected to, in amputations of the smaller parts of the limbs, when it is invariably and necessarily employed in amputations high up through the thigh and upper arm and at the hip and shoulder, and no difficulty is found in practising it at either of those parts.

CHELIUS has justly objected to the tourniquet, that it prevents the return of the blood by the veins, a circumstance too little remembered in amputation. Bleeding from the arteries is, in general, cautiously guarded against; but bleeding from the veins is thought of no importance, and by some indeed actually advantageous, which is however a most serious mistake. It must not be supposed that when the tourniquet is applied, all flow of blood to the part of the limb below is stopped, for such is not the case, as is decidedly proved by the filling almost to bursting of the superficial veins, and the generally congested state of the whole part, in consequence of which directly the knife begins to cut the blood streams forth in torrents, frequently with the observation that it is only venous blood, forgetting that this venous blood must be so much withdrawn from the general circulation, of which the patient not unfrequently soon feels the effect, becomes pallid and covered with cold sweat and now and then swoons. All this depends on the tourniquet bandage which has dammed up the current from below, without any possible benefit.

But admitting for argument's sake, that a free flow of venous blood at an amputation is generally advantageous, which, however, I agree with many others in denying, yet there are occasions and those not unfrequent, where it is positively dangerous and occasionally fatal to the patient. A healthy person who, by wound of, or from severe tearing or compound fracture of a limb, has lost a considerable quantity of blood, and has been so completely pulled down by it, that it is often necessary to administer stimulants and wait for hours till his circulation have recovered, and the immediate effect of the bleeding have gone off, such person cannot bear to lose any blood, and the operator must take every precaution, and it may be even tie the principal artery before amputating, for the purpose of guarding against loss of blood. Neither can a patient who is on the very verge of hectic, the result of any local disease or excited during the progress of a severe injury, bear any loss of blood during an amputation; three or four ounces of venous blood suddenly escaping may be fatal, or endanger him very considerably. For these reasons bleeding from the veins is not to be thought lightly of, and therefore compression by the thumbs is better than the tourniquet, as it checks the great flow of blood to the limb, and does not prevent the return, by the veins, of that blood which has made its way by the side channels, which cannot be closed more by the tourniquet than they are by the thumbs. Some Surgeons advise tying the principal artery first before amputating, if the limb be removed near the trunk, and it cannot be doubted this is the safest method; I have done this on two or three occasions; but at other times have taken up the artery directly it was cut through and afterwards finished the operation, and upon the whole I think this is the better practice of the two, when there seems to be a necessity for either.—J. F. S.]

2682. The *formation of such wound that the bone can be properly covered with soft parts*, it has, in general, been attempted to effect in two ways, *a. by cutting circularly into the soft parts down to the bone*, or *Amputation by the circular cut* (*Amputation durch der Zirkelschnitt*, Germ.; *Amputation circulaire*, Fr.); and *β. by separating the soft parts from the bone in shape of a flap*, or *Amputation with a flap* (*Lappenamputation*, Germ.; *Amputation à lambeaux*, Fr.)

2683. History presents many modes of meeting the just-mentioned requirements by the *circular cut.* Celsus (*a*) had already expressly directed that the skin and muscles should at one stroke be cut into down to the bone, that they should be well drawn up, and be again divided from the bone higher up, so that the bone might be covered and union of the parts, drawn over it, might be effected. At a later period, however, this direction was so considerably departed from, that the skin and muscles being merely drawn up, were divided down to the bone with one circular cut, and the bone sawn off.

2684. The impossibility, by this method, of drawing the divided parts over the bone and covering it, necessarily rendered this a violent proceeding, the suppuration was always considerable, the bone stuck out, or was only partially covered, and a bad scar was formed. For these reasons, various modes were tried to save as much skin and muscular substance as would be sufficient for the due and perfect covering of the stump.

2685. Here belong the various methods of dividing the skin and muscles in different steps and with several cuts. Petit (*b*) divided the skin with a circular cut down to the muscles, separated it a little more, drew it back, cut through the muscles at the edge of the skin so drawn back, and after sawing through the bone, covered the surface of the wound with the skin which had been saved. With this agreed the later practice of Mynors (*c*), who considered a pad of flesh unnecessary; he divided the skin with a circular cut, dissected it off to a proper distance, and cut through the mass of muscle vertically down to the bone. Very recently, Brünninghausen (*d*) has followed a similar practice, except that he does not divide the skin by one circular, but by two semicircular cuts, and dissects them back so as to form two semilunar flaps; the muscles are then cut through vertically to the bone.

2686. For the purpose of making a wound with a conical surface in the upper part of which is the bone, Louis (*e*) has directed cutting through the skin and superficial muscles with the first cut, to draw them back, and at their edge to cut through the deep muscles down to the bone.

Alanson (*f*) proposed a particular mode of forming a conical wound surface, to make which when the skin is divided by a circular cut, separated from the muscles and turned back, the knife must be so placed that

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(*a*) De Medicinâ, lib. vii. cap. xxxiii.
(*b*) Traité des Maladies Chirurgicales, vol. iii. p. 150.
(*c*) Above cited, p. 19.
(*d*) Above cited.
(*e*) Above cited, p. 358.
(*f*) Above cited, p. 12.

its edge is directed obliquely upwards and inwards, and whilst carrying it round the whole limb in this direction, all the muscles are cut through to the bone, so that a hollow wound is formed, at the top of which the bone is sawn off. In practice, however, it is found impossible to carry the knife in a circle round the limb as directed, as it cannot travel except in a spiral line (*a*). This method, therefore, found but few adherents (*b*), and was set aside by other manœuvres, by which a conical wound surface could be formed in the muscular substance.

2687. According to Gooch and Bell (*c*), the skin and muscl eshould be divided with one circular cut down to the bone, then the knife thrust in about an inch higher between the muscle and the bone and carried round, and lastly, the bone sawn through still higher than the cut through the muscles.

Desault (*d*) cut through the muscles layer by layer, always allowing one to retract before he cut through another, and so proceeded till he reached the bone.

Richter (*e*) practised a similar method with his fourfold circular cut, in which, with the first circular cut he divided the skin, which he allowed to retract, and at its retracted edge, with three several circular cuts he reached the bone; in doing this, the divided layer of muscles retracted, and those still remaining were cut through higher up.

Boyer (*f*) divides the skin with the first circular cut, and by a second half through the superficial muscles, and on their retraction cuts through the deep layer, and finishes by dividing with a bistoury the remaining fibres attached to the bone, together with the *periosteum*.

2688. Graefe (*g*) again takes up Alanson's notion of a funnel-shaped cut with one stroke of the knife, and manages it with a sort of leaf-shaped knife, (*Blattmesser*,) the blade of which is bellied in front, and becomes narrower and narrower towards the handle. When the skin has been divided with one circular cut and drawn back, the bellied part of the knife is placed on its edge with the cutting part obliquely upwards, carried with a single stroke in this direction around the whole limb, and the muscles are thus cut through to the bone.

2689. Dupuytren (*h*), for the purpose of diminishing the pain in the division of the skin and muscles, employed Celsus's method (*par.* 2683.) An assistant drew the skin well back, and he then divided the skin and muscles at *one stroke* to the bone; the muscles hereupon retract, and those still remaining attached are cut through higher, so that in this way a conical wound is produced.

Wilhelm operates in like manner (*i*).

2690. In the history of the circular cut the proposals of Valentin and Portal to prevent the projection of the bone must also be mentioned; according to the former, the muscles should each time be cut through in their greatest degree of extension, according to the latter, just the contrary.

2691. *Flap-Amputations* were first invented by Lowdham (*k*) in the

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(*a*) Wandenberg, Briefe, vol. ii. part i. p 21.

(*b*) Loder, Programm. De novâ Amputatione Alansoni. Jenæ, 1784.

(*c*) Above cited, p. 340.

(*d*) Above cited, p. 276.

(*e*) Medicinisch und chirurgische Bemerkungen, vol. i. p. 284.

(*f*) Traité des Maladies Chirurgicales et les Opérations qui leur conviennent, vol. xi. p. 156. Paris, 1822–26. Third Edition.

(*g*) Above cited, pl. vii. fig. 6, 7.

(*h*) Sabatier, Médecine Opératoire, vol. iv. p. 471. 1824. New Edition.—Dupuytren, above cited, vol. iii. p. 283.

(*i*) Klinische Chirurgie, vol. i. München, 1830.

(*k*) Yonge's Currus triumphalis e terebinthinâ. London, 1679.

seventeenth century; in amputating the leg, he made, from the calf, a pillow in shape of a flap, for the purpose of covering the stump. Verduin (*a*) and Sabourin (*b*) afterwards arrogated this discovery. Flap amputations, restricted by their inventor to the leg, were applied to the thigh also by Ravaton (*c*) and Vermale (*d*), and with them commenced *Amputation with two flaps*. They always made use of flaps, in doing which, the knife was thrust through the whole mass of limb to the bone, carried some distance beyond it, and then the parts divided outwards. Langenbeck (*e*) forms flaps, either one or two, by a deep cut from without, inwards towards the bone.

Upon flap-amputations may further be consulted

Salzmann, De novo Amputationis Methodo. Argent., 1722.

La Faye, Histoire de l'Amputation suivant la Méthode de Verduin et Sabourin; in Mémoires de l'Acad. de Chirurg., vol. ii. p. 243.

Garengeot; in same, p. 261.

O'Halloran, A Complete Treatise on Gangrene and Sphacelus; with a new Method of Amputation. London, 1765. 8vo.

Siebold, Dissert. de Amputatione Femoris cum relictis duobus carnis segmentis. Wirceb., 1782.

2692. Pott's (*f*) method must be considered as a compound of the circular and flap operations, he cut into the muscle first on the one, and then on the other side obliquely from below upwards, and thus formed a wedge-like wound. Siebold's (*g*) proposal corresponds to it, and consists, after cutting through and drawing back the skin, in making the cut through the muscles obliquely upwards, first on the outer, and then on the inner side, by which a wound is formed as in Pott's method. Here also belongs Schreiner's (*h*) plan of dividing the skin and muscles with one circular cut down to the bone, and then by cutting upwards on each side with a bistoury to the bone, forming two flaps, which he separated from the bone, and sawed the latter off in the angle.

Herewith must also be placed the modes of proceeding which, by Langenbeck and Scoutetten, are confined to disarticulations, the *oval cut* also used in amputating the continuity of the limb, the *oblique cut* of Sedillot, Baudens, and Malgaigne, the *sloping cut* of Blasius (*i*); in making which, the soft parts are divided in an oblique surface, or in form of the mouth-piece of a clarionet, or in the form of △, so that the point of the cut is on the front of the limb, a little above the part where the bone is sawn through, and the rather rounded base is behind and below. Sedillot, Baudens, and Malgaigne, divide in this way, the skin alone, separate it, and divide the muscles higher with the circular cut. Blasius, with a peculiar knife makes two cuts through the soft parts, which both pass obliquely to the long and thick diameter of the limb, and unite at their end, by which a wound is made, presenting an obliquely cut out funnel or cornet, and has close below the place of division of the bone, a re-entering,

(*a*) Epistola de nova Artuum decurtandorum ratione. Amstel., 1696.

(*b*) Mangetti, Bibliotheca Chirurgica, vol. ii. p. 255.

(*c*) Le Dran, Traité des Opérations de Chirurgie, p. 564. Paris, 1742.

(*d*) Observations de Chirurgie pratique, précédées d'une Nouvelle Méthode d'Amputation. Mannheim, 1767.

(*e*) Bibliothek für die Chirurgie, vol. iii. part ii. vol. iv. part iii.

(*f*) Above cited, p. .

(*g*) Salzburg. Med.-Chirurg. Zeitung, vol. ii. p. 44. 1812.

(*h*) Above cited, p. 162.

(*i*) Der Schrägschnitt, Eine neue Amputations Methode, u. s. w. Berlin, 1838.—Handbuch der Chirurgie, vol. iii. p. 377. Second Edition.—Oppenheim's Zeitschrift für die gesammte Medecin. Jan., 1843; p. 10.

Λ shaped angle to the wound, and two-thirds or the whole of the diameter of the limb lower, a projecting V shaped lip to the wound, which in closing the wound, drops into each corner, but can never be brought directly opposite.

2693. When the muscles have been thus divided down to the bone, they are held back by an assistant with a *cleft cloth* (1), at the edge of which the muscular fibres connected with and also projecting from the bone, and the *periosteum*, are divided with a circular cut. The left thumb-nail is now placed close to the face of the stump, for the purpose of guiding the saw, which at first and towards the last, when the bone is nearly sawn through, must be moved more slowly, and with shorter strokes (2). Whilst the sawing is in progress, the assistant who holds the limb must not move it either up or down, because in the former case he fixes the saw, and in the latter, breaks the bone. If any bony points remain, they must be cut off with the bone-nippers, or removed with a file or a fine saw.

The cleft cloth to keep the muscles back, is better than the *retractors* of Bell and Klein. Scraping off the *periosteum* is superfluous. Walther and Brünninghausen divide the *periosteum* by a circular cut about half an inch below where the bone is to be sawn through, and turn it up, so that after the sawing, the end of the bone may be covered by it. They imagine that it promotes union!

The saw commonly in use is the bone-saw, or Pott's plate-saw.

[(1) I do not think there is any great advantage gained by using the cleft cloth, and very rarely employ it; as, by passing the thumb and forefinger on either side of the bone or bones, and pressing the palm of the hand and ball of the thumb against the surface of the stump, the soft parts can be pressed well back, and out of the way of the saw, which should be applied as closely as possible, to the cut ends of the muscles.

(2) It will not be superfluous to say a few words about the use of the saw, which is probably one of the worst-used surgical instruments. A good saw should have its teeth well set off, as the carpenter's expression is, that it may neither clog nor hang in its track; and it should have, proportionally to its size, a heavy back, which renders its steadying more easy, and affords all the weight the saw requires to be loaded with. The too frequent mode of using the saw, is to drop its end, whilst the handle is raised, so that when moved it works obliquely; the operator, at the same time, throwing as much of his own weight as he can conveniently spare upon the handle, as if with the intention of forcing the blade of the saw at one or two strokes through the bone, and then driving it downwards and upwards, as violently and quickly as he can, and often using about as much of the toothed edge as a young violinist does of his fiddle-bow. The consequence is, that the saw works badly, is continually jumping out of its track, makes another, and finishes by splintering the bone, and often cutting through it below where it was purposed. To use a saw properly, it should always, where possible, be held and worked horizontally, moving it forwards and backwards without any pressure of the hand, but allowing merely its own weight to keep it on the appointed place; and as it is moved forwards, even its own weight should be lessened, by slightly supporting, instead of pressing down the saw. After drawing the toothed edge first backwards, and then moving it forwards lightly on the bone, till a shallow track is made, it may be moved freely, so that at least two-thirds, or even more of the saw shall act. The strokes should not be quick, but long; and if so made, four or six of them will cut through the thigh- or shin-bone, more quickly and more cleanly than twice as many short, hurried strokes, and without any risk of splintering the bone, or slipping from the part chosen to saw through.—J. F. S.

Liston (*a*) thinks that working the saw vertically is preferable to horizontally; "for thus, when the section is nearly completed, the uncut part of bone is deep, and less likely to snap on the weight of the limb being allowed to operate, or when undue pressure is made downwards." He thinks, also, that "the regulating of the position of the limb during sawing, should not be intrusted to the assistant alone. He may, from anxiety to facilitate the action of the saw, snap the bone and splinter it, when it has been little more than half divided; or from dread of this, he may lock the instrument, and so delay the completion of the operation. The management of the lower part of the limb should always be by the person using the saw." (p. 764.)

(*a*) Elements of Surgery,

I do not think there is more danger in giving the lower part of the limb to an assistant than the upper; for if the operator hold the lower end, the last portion of the bone is just as likely to be snapped through by the muscles above, when they begin to lose the counterpoise of the limb below, if not specially guarded against. This I have seen, again and again, in amputation through the thigh, that when the bone has been sawn through steadily, and without a splinter, the moment the saw has passed through, up jumps the stump.

One point, however, should never be forgotten, to wit, that immediately the soft parts are completely divided, the assistant should grasp the limb below, as near as possible to the place of sawing; and if he have from circumstances, grasped the bone or bones below that which will be sawn through, he should change his grasp, and fix it on the end of the bone just about to be cut through. This specially applies where amputation is performed for diseases of joints, as then the joint is too tender to permit being taken hold of, till its nerves have been divided by the cuts of the operation.—J. F. S.]

2694. After the bone has been sawn through, *the divided vessels must be tied*, according to the rules already given *(par.* 291.) The principal artery is to be first tied, and afterwards the smaller ones. For this purpose, it is not necessary to relieve the pressure on the arteries, so that the mouths of the vessels should be seen by the spouting of the blood; anatomical knowledge must here guide the operator. All the spouting vessels having been tied, warm water must be allowed to flow over the wound to ascertain whether there be any little vessel still bleeding. The more carefully the vessels are tied, the less need is there for the application of cold water, which is generally only necessary when there is trickling of blood from vessels which cannot be distinguished, so as to ensure the patient against after-bleeding.

The best material for ligatures is round, not very thick, but sufficiently strong silk threads; either both ends of which may be cut off close to the knot, or only one is cut off at the knot, and the remaining one led the nearest way out to the surface of the wound, where it must be fixed to the skin with sticking plaster *(par.* 293.) What has been already said *(par.* 297) in reference to torsion, applies here.

In the history of amputation, the mode of stanching the blood is of the greatest importance, as its well-doing and less danger are in the closest relation with the manner in which the stanching of the blood is effected. Before AMBROSE PARÉ, in 1582, re-employed the separate tying of vessels, already known, from GALEN and AETIUS, Surgeons endeavoured to stanch the bleeding with boiling oil and pitch, into which the stump was plunged, or with the actual cautery; or the amputation was performed with a red-hot knife. Tying the arteries at first met with violent opposition, and but few supporters (GUILLEMEAU, DE LA MOTTE, and others.) From the absence of precaution against bleeding, together with the unfitting form of the ligature instruments, the practice of tying the arteries was very difficult, and the bleeding rendered amputation dangerous, on which account, in many cases, it was not undertaken. Only on the invention of the tourniquet, by MOREL, in 1674, and its improvement by PETIT, in 1718, did amputation become more general. For the stanching of bleeding, however, the vitriol button, actual cautery, the stick, and tourniquet, were still used in preference. The dread of cutting through the artery in tying it when isolated, led to tying the artery and passing the ligature through it, till this, as well as all the earlier modes of stanching the blood, yielded completely to tying the vessel alone. It is incomprehensible that in the present time there should still be some, who, instead of the simple and safe practice of tying, employ the constant application of cold water; or in flap-amputations, the compression of the principal arteries in the flap against the bony stump, and even recommend it (*a.*)

[The bleeding after an amputation is not always from the arteries, but sometimes though the arteries have been tied, and the tourniquet taken off, and sometimes when the tourniquet has not been used, the larger veins pour out, and will not be stopped,

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(*a*) KOCH, De præstantissima Amputationis methodo. Landsch., 1826. On the contrary, compare VON GRAEFE; in his Journal für Chirurgie und Augenheilkunde, vol. xii. p. 18.

as they usually can be by pressure for a few minutes with the finger. Under such circumstances, they must be tied without hesitation, and generally no evil results follow. One of my late colleagues, TYRRELL, always tied the veins at once, if they seemed disposed to bleed. I have tied the femoral vein many times, and in but a single case with ill consequence; the patient had inflammation and pus in the iliac vein; but as this occasionally happens, without a ligature having been applied, it may be questionable, whether the ligature was the cause of the mischief or not.—J. F. S.]

2695. When the vessels are all properly tied, after the wound is cleansed from blood, and the surrounding parts are dried, *the dressing must be proceeded with*, which effects the cure of the wound, either by quick union, or by suppuration and granulation.

Many Surgeons leave the wound open from six to ten hours, and during this time cover it with sponge or compresses, dipped in cold water, for the purpose of thus guarding against after-bleeding. DUPUYTREN (*a*) specially advised this mode of treatment, and followed it in all cases. The advantage of this proceeding is, that if an after-bleeding ensue, the vessel can be at once tied. Small retracted vessels, generally, do not bleed, even if some time be occupied with the operation; they are retracted among the spasmodically contracted parts, but some hours after when this condition subsides, or there is a greater flow of blood to the wound, they begin to bleed. If the dressing have been applied, the bleeding is first noticed, when it becomes completely penetrated by the blood. The wound is filled with clotted blood, which renders the discovery of the vessels very difficult. I have treated in this way those cases only where peculiar circumstances afforded the probability of an after-bleeding; as a general practice, however, I do not think it advantageous.

[CHELIUS's opinion on this subject is most certainly correct, the exposure of the surface of the stump should be the exception and not the rule; and if practised, should not be continued more than three or four hours, within which time, with due attention the patient's warmth and circulation will generally have recovered the immediate shock of the operation, and the clots in the little vessels will either have been forced out or become so completely fixed as to prevent bleeding. The practice sometimes adopted of covering the whole face of the stump with a thick wad of lint dipped in water kneading it in, and leaving it on for twelve or fourteen, or even twenty-four hours is bad; as during this time the adhesive matter is poured out, and instead of sticking the surface of the wound together, sticks the lint tightly on. so that it can only be removed with difficulty, and with great pain to the patient, and indeed, imperfectly, as the fluffy part of the lint remains tangled in the surface of the stump, the whole of which must therefore be cleared off by suppuration before union can take place. If the Surgeon will leave the face of the stump open, and will apply cold water to it, linen which has little or no fluff should be laid lightly over it and not kneaded in, and frequently replaced before it can stick firmly; but a light sponge is still better. Some practitioners leave the stump exposed, not merely to guard against after-bleeding, but because they fancy the union will be better if the surface of the wound have first glazed with the adhesive matter poured out. I have not found much advantage gained by employing this mode of proceeding.—J. F. S.]

2696. To promote quick union, after the circular cut, an expulsive bandage is put on, from the upper part of the stump nearly to the end of the sawn off bone; the edges of the wound are brought together in such close apposition as to form a vertical cleft (1), and in this position are fixed with strips of sticking plaster, passed from one side of the stump to the other, so that the wound is completely covered. Upon the plaster is laid, in the direction of the wound a pledget, and over it a wad of lint, which is fastened with a compress laid crossways over the stump, with some descending turns of a roller, also made to pass over the face of the stump. The tourniquet is applied loosely, so as to compress the artery in case of bleeding. The patient is put to bed, the stump so placed upon a pillow, that the cut surface is a little higher than the nearest joint, and protected (by a cradle) so that it be not pressed by the bedclothes. On account of the

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(*a*) Above cited, p. 411.

disposition to cold shivering, the patient should be covered up warmly, and take a cup of warm tea, or broth.

The application of the sticking plaster over the expulsive bandage, is preferable to that of putting on the plaster first and the bandage after, because the plaster keeps more firm, does not so easily shift, and does not so readily excite erysipelatous inflammation of the skin (2). I have never noticed, from completely covering up the wound with plaster, any inconvenience from collection of the secretions of the wound; whilst indeed the edges of the wound as they swell, protrude irregularly, and often are completely strangulated if a space be left uncovered between two pieces of sticking plaster (3).

[(1) With regard to the direction in which the edges of the wound should be brought together, it is questionable whether the vertical one is the best, or whether the horizontal one be not preferable; I have tried both again and again, and I am rather more inclined to bring the edges together in a horizontal line, especially in amputations on the lower limb, because without effort and simply by the position on its hind surface, on which the stump rests, the soft parts are kept closer together, whilst if the edges be brought together vertically, the resting part of the stump necessarily tends to keep the cut surfaces asunder. It may be objected, that the horizontal fitting together does not encourage the escape of the fluid from the stump so much as when the edges are brought together vertically, and renders the bagging of matter and sinuses more likely, but this is not the case, and when it happens, depends more commonly on the carelessness with which the after-dressings are made. I have, however, seen many very good stumps made in both ways.

(2) Chelius's recommendation of, and reason for, applying a bandage first, and the plaster after are very good, but it must not be supposed a long bandage should be applied; a covering to the stump a single turn thick, is all that is proper or necessary to bring the soft parts well down to the end of the sawn bone, but more than this heats the stump. I do not agree with him in covering the whole face of the stump with plaster, the less of this the better, provided the object of keeping the skin close upon the face of the stump be effected; but I have not generally noticed the protrusion of the swelling edges between the gaps of the plaster, unless the plaster have been too tightly applied, which however is often done, and the lips of the wound dragged together as tightly as possible, a proceeding bad, painful and useless, and generally consequent on too little skin having been saved so that the edges will not, if the wound be *properly* dressed, come together at all. It should be remembered, that the plaster is not to pull the wounded surfaces together, but merely to support them when they are fitted together. I think it therefore better not to fix one end of the strip of plaster on one side, carry it across the face of the stump, drag the edges of the wound together, and fix the other end on the other side, but whilst an assistant gently brings the edges of the wound together with the finger and thumb of each hand above and below, to place the middle of the plaster strap across it, and then run the ends up along the sides of the stump; this brings the cut surfaces into better contact, and gives all the support necessary without giving the patient pain. The first strap should be put on the middle of the stump, and one or two above and below it, a quarter of an inch apart, that whatever fluid oozes out may readily escape, for otherwise, in nine cases out of ten, most certainly quick union of the cut surfaces will be interfered with, if not prevented, and the wound will have to unite by granulation, and not be cured within eight or ten weeks, instead of three or four as commonly, and sometimes in a fortnight as I have not unfrequently seen. As to the protrusion of the swollen edges of the wound, when this happens it is easily controlled either by merely snipping the tight strap a little, near the wound, or by cutting it across just at the edge of the circular bandage, the plaster with which it is spread being softened by the warmth of the stump readily, in the course of a few minutes allows the strap to move down and the swelling disappears.

As to the plaster for dressing stumps, provided it be not stimulating, it is not of much consequence whichever is chosen. That commonly used in our Hospital practice is soap plaster with a little resin, to make it more sticky; but I prefer the soap plaster alone. Tyrrell thought equal parts of soap plaster and compound frankincense plaster made the best dressing. Liston prefers a solution of isinglass in spirits of wine, spread on oiled silk; and Torboch, of Sunderland, recommends caoutchouc web, straps of which are said to be capable, from their elasticity, of yielding to the swelling around the wound. The fact is, however, that it is matter of little consequence what is used, if it do not irritate, and the Surgeon may follow his own fancy.

(3) Covering up a stump with pledgets and compress and roller, after the plaster strips are applied, is better left alone, as they heat the stump and encourage suppuration.

The stump should be kept as cool as possible, and when the patient is in bed, it is a very good practice to lay a thin, cold, wet linen rag lightly over the stump, and repeatedly renew it. The cradle (4) also, should be merely covered with a sheet, though the patient's trunk and other limbs should be sufficiently covered to keep him warm, without making him hot.

(4) Cradles are generally made of half circles of stiff iron wire, the ends of which are fixed firmly in two pieces of wood, about eighteen inches or two feet long, as a base, above which the wires rise about twelve or eighteen inches, and support the bed-clothes away from the limb. As the comfort to the patient from the use of this apparatus is great, and it cannot always be obtained in country practice, directly when wanted, it is well to know how to make a substitute or makeshift. A common-sized, flat wash-tub hoop, sawn across, and each half sawn down the middle, furnishes the arches, two, three, or more, as may be needed, and these, having their ends nailed to a lathe on each side, make a very good cradle.—J. F. S.]

2697. The dressing after flap-amputation is to be put on in the same way, excepting that if but one flap be made, it must be laid over the surface of the wound, and its edge fitted closely to the corresponding edge of the skin with sticking plaster and compresses, applied in the direction of the flap, and kept in place by a bandage, of which several turns should pass over the front of the flap. If the amputation be with two flaps, both their surfaces must be brought together, and their edges made to fit completely, and so kept with the dressings already directed. Union of an amputation wound with sutures I consider injurious.

[I do not think it of much consequence whether sutures be used or not, in bringing the edges of the wound together; sometimes I use them, sometimes not, as I feel disposed at the time; but I have never seen any inconvenience arise from their employment, and therefore the Surgeon, I think, may use his own discretion, in regard to them.—J. F. S.]

2698. If the amputation wound be to be cured by suppuration and granulation, then, after having put on the expulsive bandage, a pledget spread with mild ointment must be inserted between the edges, straps of plaster laid transversely across, to bring its edges together, and afterwards a compress and bandage, as already mentioned.

[I can scarcely imagine a case in which this treatment of a stump can be called for. Occasionally, indeed, it happens that the surface of a stump will become sloughy, and then must unite by granulation; but to make a positive determination to promote union by granulation from the first, can hardly be warranted under any circumstances. —J. F. S.]

2699. The further treatment of the patient and of the wound must be conducted according to the rules laid down for wounds in general.

The accidents which may ensue after amputation are, after-bleeding, violent inflammation, erythism, torpor, gangrene, very copious secretion and bagging of matter, nervous symptoms, protrusion of the bone, suppuration, and exfoliation of its edge, and ulceration of the soft parts.

2700. The patient should observe the strictest bodily and mental quiet. On the first day he should take merely a little broth and almond milk. An assistant conversant with the use of the tourniquet should be near him; and dressings and every necessary for tying vessels should be in the bed-chamber.

If nothing untoward occur, if the general reaction keep up, and if in the stump inflammation ensue within the bounds necessary for the union of the wound, the dressing may be left till fouled by the discharge from the wound, or its renewal on account of ill smell be required. If the discharge be very slight, it often dries up quickly, and the dressings may be left off in the third week, when, after removing the first dressing, I have found the wound completely healed.

In taking off the dressings, all its clinging portions should be well softened with lukewarm water, and in doing this, as well as in re-applying the dressing, dragging the ligature-threads should be carefully avoided. Every day, or every other day, or still less frequently, according to the quantity of discharge, should the dressing in this way be replaced. If any parts remain ununited, the clotted blood or the pus must be emptied by gentle pressure. On the seventh or eighth day, it may be attempted to remove the ligatures on the small vessels with a gentle pull, and those of the larger ones towards the twelfth and sixteenth. They, however, often remain for a longer time, being held fast by the granulations; the ligature must then be twisted between the fingers, and pulled at the same time (1.) I have never seen inconvenience from the ligatures being long retained. The same plan is to be continued till the scarring of the wound be completed; and for some weeks after, the stump must be covered up, and the scar protected from the dragging of the muscles with a bandage. An artificial leg can only be fitted when the scar has become quite tough and the edge of the bone is rounded.

The general treatment must depend on the different periods of the cure, and according to the condition of the general health. Proper regulation of the diet, if no particular symptoms occur, renders the use of medicine in most cases superfluous.

Benedict's (*a*) mode of treatment in which the stump is wetted with spirits of wine and bark, and valerian and volatile stimulants given internally at the same time, immediately after the operation, is generally objectionable.

[(1) I am not disposed, even when a ligature is retained three or four weeks, to do more than make a gentle pull upon it; for I have known awkward consequences from greater energy. If the ligature, therefore, cannot be got away easily, it is better to fasten its end to a thin piece of whalebone, fixed with sticking plaster on the side and bent over the face of the stump, so as to form a spring; the gentle and constant pull which this makes, generally brings the ligature away in two or three days.—J. F. S.]

2701. Should *after-bleeding* occur, it must be managed as already directed in the treatment of wounds in general (*par.* 302.) If it be not considerable, but from small vessels immediately after the amputation, the tourniquet must be screwed tight, and cold water poured over the stump for some time. But if the bleeding be greater, if it come from the branches of an artery, or from the trunk itself, then after the tourniquet has been properly tightened, the dressing must be removed, the wound cleared of the clotted blood, and the bleeding vessel tied. If this cannot be done, a sponge dipped in ice-cold water must be applied immediately upon the wound, and pressure also made upon it. Plugs strewed with styptic powders, and bound on with a compressive bandage, may also be here useful (1). If the after-bleeding come on with smart fever, with violent beating of the arteries, and great heat in the stump, it may often be stayed by a free blood-letting, and by continued cold applications to the stump.

If the bleeding happen later, and cannot be stanched by either of the above-mentioned means, which is usually the case, because the edges of the wound are for the most part united, or the walls of the arteries, on account of their inflammatory condition, baffle the operation of any ligature, the

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(*a*) Dresdner Zeitschrift für Natur und Heilkunde, vol. iv. part iii.

trunk of the vessel must be cut down upon and tied at some distance from the seat of amputation (2). This practice is simple and safe, as the experience of Dupuytren, Delpech, Zang, and myself have proved.

The so-called *parenchymatous bleeding*, where the blood trickles from the whole surface of the wound as from a sponge, depends either on irritation of the wound being kept up by improper or too tight dressing, or on the loss of tone of the capillary vessels, or on copious suppuration, in weakly cachectic persons. In the first case, the dressing must be properly adjusted, and every thing which can irritate the wound removed; in the second, those means must be employed which will raise the tone of the capillary system, as the mineral acids and quinine; cold applications and other styptics must be made to the stump with moderate pressure; and even the actual cautery (3) or tying the trunk of the artery above the bleeding part, resorted to (*a*).

When in ossification or cartilaginous thickening of the arteries, their tying with a broad tape does not secure against after-bleeding, nothing remains, if this happen, but smart application of the actual cautery, or tying the principal trunk above the amputation (*b*).

[(1) I do not think the application of a tourniquet to arrest bleeding is advantageous, as the blood will find its way into the veins and they will bleed. But I think it best, if the bleeding occur within a few hours after the operation, to open the stump completely, and clear away every particle of clotted blood, and especially, to get it out of all the chinks between the muscles. If this be done, and the stump exposed to the air for an hour or two, it frequently ceases to bleed. If any vessels be found bleeding, they must be at once taken up. I do not like plugs, either simply such, or with the addition of styptics, as they always irritate, and usually are inefficient.

(2) It is only in very rare cases that the principal artery should be tied at a distance from the stump, and in general I do not believe it called for. It does not often happen that the bleeding is at first so alarming as to warrant even disturbing the stump; for I have several times seen bleeding occur two or three times during the course of cure, and yet, merely by keeping the patient as low as his condition will permit, and the stump cool, no further mischief ensues. But when the bleeding recurs again and again, and increases in quantity, there is always reason to suspect that there is a cavity within the walls of the stump, into which the bleeding vessel opens, and that the irritation of the clot therein keeps up the bleeding. If this seem probable, the finger must be gently insinuated between the edges of the wound, till the whole cavity be laid open, and then the entire clot must be cleared away, and if possible, the vessel which has bled must be found. If it do not then bleed, it had better be left exposed to the air, and often this simple proceeding puts an end to the business. But should it bleed again, I think, from my own experience, and from the practice of others which I have observed, that it is better to follow a bleeding vessel up the wound, and more especially, if it be near the edge, as then, a probe having been passed into it, the skin may be cut through, and the vessel easily and properly secured. This seems preferable to tying the main trunk, by which the supply of blood necessary for the union of the wound is, in general, either completely cut off, or withheld for some days, and a sloughing condition is the result. And sometimes, even the collateral circulation is so free that tying the principal artery will not stop the bleeding.

(3) The use of the actual cautery in after-bleeding especially, if it come on some days subsequent to the operation is excellent practice. Some examples of it I have already mentioned (*par.* 302, *note.*)—J. F. S.]

2702. If *violent inflammation of the stump* occur, it must be reduced to proper bounds, by less tight application of the dressing, by continual cold applications, and by keeping the patient cool. If the inflammation be so great, that it is accompanied with much fever, it will require, according to the patient's constitution, a strictly antiphlogistic treatment.

If there be an erythetic condition, as frequently happens with very sensitive persons, in which the stump is very tender, painfully tense, and

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(*a*) Chelius, Ueber Nachblutung nach Amputationen; in Heidelb. klinisch. Annalen, vol. iii. part iii. p. 337.

(*b*) Chelius, Bericht ueber die Errichtung der chirurgischen Klinik, p. 16.

burning, the heat much raised, the redness of the edges of the skin and wound very slight, the patient exceedingly restless, the pulse contracted and quick, and the countenance anxious, ice-cold water must be applied to the stump, till the heat be diminished, and internally *aqua lauro-cerasi*, opium with nitre, almond milk, oily mixtures and purgative clysters, must be given, and the patient should take light nourishing food. If the inflammation be accompanied with erythism, leeches and emulsions with camphor and nitre must be employed.

The cause of death after amputation, is not unfrequently inflammation of the vessels; in some cases the veins, in others the arteries are inflamed, often even to the heart, and sometimes filled with pus. In such instances, the stump is excessively tender, accompanied with severe shiverings, and very depressing sweats. Local bloodletting and cold applications, with calomel internally, must be here used.

2703. An *insufficient degree of inflammation*, or *a torpid state*, in which the stump is little or not at all painful, the warmth little, even less than natural, the wound flabby and pallid, with a frequent secretion of serous or clammy ichor, the patient very much depressed, and the pulse very small, weak, and quick, requires both a general and local strengthening and exciting mode of treatment. The stump must be bathed with spirituous aromatic remedies, covered with aromatic poultices, mixed with camphor, the dressings moistened with spirit of camphor, or of turpentine, the edges of the wound washed with them, and some even injected into it.

2704. *Sloughing* requires various treatment according to its cause. (*par.* 71.)

2705. In *copious suppuration*, strengthening remedies must be used both internally and externally. If collections of pus form, its free escape should to the utmost be provided for. With this view a part of the wound not being drawn together with sticking plaster, the pus should be emptied by moderate pressure and injections, and a proper bandage applied. It is rarely necessary to make use of the knife.

2706. *Protrusion of the bone* is either the result of an improperly performed operation, in which too little soft parts are preserved, and these with difficulty drawn over the bone; or copious suppuration and a torpid state come on, in which the muscles and cellular tissue visibly waste and retract. In the former case, if the muscular surface itself do not project in a rounded form, nothing can be done but waiting for the exfoliation of the bone, to promote which, the marrow must be destroyed, and a bougie dipped in spirits of wine, thrust into its cavity, or the projecting bone must be sawn off. But if the muscular mass do protrude, the superficial muscles must be pressed back, a portion of those attached to the bone removed, and the bone itself sawn off at the necessary height. In the latter case, I have almost invariably observed a fatal result from wasting suppuration. Proper general and local treatment of this torpid state, and when it is removed, and the soft parts have not applied themselves over the bone, which, however, I have frequently noticed, then the above-mentioned destruction of the marrow in the projecting piece of bone, for the purpose of encouraging its exfoliation, or sawing off the bone, is the only thing which can be done. Pushing forwards the muscles and skin, by bandaging, will not in this case prevent the protrusion of the bone; on the contrary, every bandage which makes much pressure, and draws the parts together, renders this state worse, as it increases the consuming suppuration and the wasting absorption.

[Protrusion of the bone is one of the most tiresome and vexatious consequences of amputation, as, although it more frequently arises from the circumstances mentioned by Chelius, yet it occasionally happens, when, although at the time of the operation an ample covering of soft parts had been preserved, after-bleeding comes on some days afterwards, and the wound requiring to be opened completely once or twice, or even more, the soft parts retract, cannot be restored to their first situation, and the bone protrudes. Or sometimes, though there be plenty of soft parts, the dressings may have been too tightly applied, and the soft parts being pressed by it over the bone, slough, even although the mischief be quickly discovered and the pressure removed. Exfoliation, however, is not always the necessary consequence, for I have seen instances in which a bone protruding half an inch has not lost its vitality, but itself granulates, and is also covered by the granulations of the soft parts, and the stump, by careful dressing, heals as well as can be desired, though slowly, and becomes well shaped. When exfoliation does take place, it is often confined to a small portion of, or a mere ring of the end of the bone, and then scarring soon follows. But occasionally, though rarely, the bone dies, to some distance, from the face of the stump, and a long portion is thrown off. I hardly, however, recollect an instance in which any material inconvenience even, excepting retarding the cure, much less serious symptoms, have arisen in consequence. The wound generally heals, except a small ring of granulations around the bone, and there is little trouble with it.

For these reasons, I cannot agree with the violent proceeding of exciting exfoliation by destroying the cancellous structure, nor even with the less severe operation of sawing off the end of the protruded bone, as it is impossible to know to what distance the mischief has extended. The case simply requires to be treated as if no bone protruded, by bringing the soft parts forward with gentle rolling; and when the bone is certainly dead and protruded, then to make occasional and gentle attempts to remove it by pulling it with dressing or other forceps.—J. F. S.]

2707. In *necrosis of the bone*, either only a thin piece of the surface, or a complete ring of it may be dead; in the former case, the necrosed piece is usually removed by absorption; in the latter, it exfoliates, up to which time the opening leading to the bone, must be kept duly open, mild injections made, and when the separation is completed, it may be pulled out.

[Sometimes very enormous pieces of protruding bone exfoliate, being thrown off from a considerable distance beyond the face of the stump. There is in St. Thomas's Museum a piece nine inches long, which came away from the stump of a thigh-bone. I recollect seeing this removed, by merely drawing it away, after several months, with dressing-forceps. The patient had not been further inconvenienced by it, than by his cure being retarded. Such cases are best left to nature; at least some half dozen cases I have seen, were left alone, gave the patient no pain, did not irritate his constitution, and came away in due time. The practice of causing exfoliation, by destroying the *medulla*, as recommended in the preceding paragraph, cannot be for a moment entertained.—J. F. S.]

2708. *Ulceration of the bone or of the soft parts* is almost invariably the consequence of some dyscrasic disease, which must be met by proper treatment. Continued superficial ulceration of the soft parts is frequently the consequence of improper dressing, or of its too early removal. A fungous growth from the medullary hole may, according to my experience, in most cases be got rid of by proper compression, and by touching it with lunar caustic; but when any dyscrasy is in causal relation to it, corresponding treatment must be employed.

[According to my experience, a fungous growth from the medullary cavity is of no consequence; and generally, the granulations inosculate with those of the soft parts, and there the matter ends, sooner or later, without further notice.—J. F. S.]

2709. As regards the *preference of the several modes of proceeding in amputation of the limbs in their continuity*, I must, according to my own experience, prefer amputation by the circular cut, and that method indeed, in which the skin is divided and drawn back, and at its edge the cut carried vertically through the muscles down to the bone, and then the muscles still remaining attached to the bone cut through still higher, and thus a conical surface of wound formed. The superior advantages ascribed to the flap-operation, to wit, a better covering of the stump with muscle, more speedy union, and therewith a shortening of the cure, over the circular operation just recommended, are groundless. In reference to the first point, BRÜNNINGHAUSEN (*a*) makes a remark which I have also observed, that the covering of the stump with muscle may indeed be effected at the moment of union and for some time, but that after a longer period the bone is merely covered with skin (1). On the other hand, after amputating the thigh with merely saving skin, I have never seen protrusion of the bone. But it must be held as an objection to flap-operations, that tying the vessels which are obliquely cut through, and often wounded in several places, is more difficult, and the number of vessels to be tied is always greater than with the circular cut, that the wound is larger, and therefore, if union do not take place, wasting suppuration is to be earlier feared. In other respects, I do not consider the dispute as to the preference of the circular or the flap-operation of so much consequence as many do, as I am convinced that the successful result depends not merely on the *mode of operation*, but on the manner of its performance, and specially, on the proper conduct of the after-treatment. The flap-operation, however, must always be considered more suitable when the amputation is performed at the upper third of the thigh; when the limb cannot be brought into a proper posture for performing the circular cut, and when the destruction of the soft parts is such, that by the flap considerable saving may be effected. I also admit, that in flap-operations, the knife suffers less than in circular operations, a circumstance of importance in Military Surgery, and that, with artificial joints, or fractures of bone requiring amputation, there may be advantage in the flap-operation (*b*).

(1) This observation, as regards both flap and circular amputations, will be found confirmed by every one who examines a stump a sufficient length of time after its complete healing. Although LANGENBECK (*c*) believes the contrary, and that it does not happen in his mode of operating, "in which the stump becomes corpulent, and the bone being completely rounded by absorption, cannot press against the muscles;" I must, however, dispute that this thickening of the stump does occur after every well performed amputation, but depends only on the skin and underlying cellular tissue, and it is a great mistake to refer it to the muscular mass. LANGENBECK may probably bear this in mind in his further observations, especially if he have the opportunity of dissecting a body which has died long after amputation; and I am convinced he will find it necessary to retract this statement. That the cure of the wound by agglutination or by suppuration makes a difference, as BLASIUS supposes, and can only be observed after the cure by quick union of the muscular bolster, I cannot, from my own experience, assent to.

TEXTOR (*d*) has only under certain conditions given preference to the old mode of treatment with the circular, or does he usually prefer the latter?

[LISTON is so great an advocate for flap-operations, to the entire exclusion of the circular, that in his ELEMENTS OF SURGERY, he does not even describe the latter operation, giving as reasons for its omission, that "its inferiority to the method by flaps, is so obvious, and so generally acknowledged, that detail of the different steps of the operation is altogether unnecessary. It is more tedious in performance, more painful to the patient, does not afford so good a covering for the end of the bone, and consequently, not so convenient and useful a support for an artificial limb, and the cure of the wound is protracted. The stump is almost always conical, the end of the bone, is ultimately at least, covered only by integument, and from even very slight pressure, this is apt to ulcerate; exfoliation of the bone follows to a greater or less extent, or unhealthy ulcer of the soft parts continues

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(*a*) Above cited, p. 58.

(*b*) CHELIUS, Bemerkungen über die Amputationen; in Heidelb. klin. Annal., vol. i. p. 190.—BECK, Ueber der Vorzüge der Lappenbildung bei der Amputationen die continuität der Gliedmassen und die ihr zukommenden Operations, etc. Freiburgh, 1819.—KLEIN, above cited, in VON GRAEFE und VON WALTHER's Journal, vol. vii. p. 173.—LANGSTAFF, Practical Observations on the healthy and morbid changes of Stumps; in Med.-Chir. Trans., vol. xvi. p. 128. 1830.

(*c*) Nosologie und Therapie der chirurgischen Krankheiten, vol. iv. p. 313.

(*d*) Neue Chiron, vol. i. p. 483.

along with *caries* of the bones, and partial death of its surface; and at length it becomes necessary either to perform a second amputation, or to curtail the length of the bone. It may sometimes succeed tolerably well when there is but one bone: when there are two, it is altogether inadmissible. In very muscular limbs, when amputation is demanded on account of destruction of the bones and joints, with laceration of the soft parts, as when the patient is not required to have pressure made on the stump, it suits well to make the flaps of integument only, and to cut the muscles short. The advocates for the circular amputation wish it to be believed, (and this is their main argument,) that the exposed surface of the flaps is much greater than that in their favourite method, * * * and have measured, it is said, the area of the one and the other, and given their verdict in favour of the roundabout incision. The accompanying drawings (pp. 770, 71) from nature, and the corresponding diagrams, speak pretty plainly in favour of the other (the flap) method. In the first there is a cone formed by the cut skin and muscles, with a corresponding hollow and ragged cavity; and the second set shows two smooth nearly triangular surfaces." (pp. 769, 70.)

As regards these serious objections to circular operations, I must observe, that in the large hospital with which I am connected, for many years, I scarcely ever witnessed the performance of any other than circular amputations, except on the fore-arm, and that the ugly consequences which LISTON has detailed, were of great rarity, and not, I believe, attributable to the mode of operation. Of late years, however, more flap-operations have been performed among us than previously, and probably, their relative number is now about the same. I have performed about an equal number of each, and the result has been so nearly the same, that in most cases, I hardly think one is to be preferred to the other. The flap-operations are more smart and showy in their performance, but in their result may be as untoward and unsatisfactory as circular operations have been stated to be. The true cause of the well or ill doing of the case is to be found in the proper or improper dressing of the stump, not merely immediately after the operation, but up to the complete union of the wound. A stump may be plentifully and superfluously covered with soft parts at the first dressing, yet if not properly managed, or if under peculiar circumstances, the patient have been very restless, and continually moving the limb, the soft parts get displaced, unite awry, and the bone protrudes more or less, or presses so against the soft parts as to cause them to slough. I have seen this occur in flap as well as in circular amputations, and I am convinced that in most cases the fault is in the dressing, and not in the operation, whichever it may be.

I believe, with FERGUSSON (*a*), that "if rapidity is to be taken as the test of superiority, the flap-operation must be allowed the preference; but in the hands of a good Surgeon, the difference of time required for the efficient performance of either, seems of so little consequence, that such a calculation should not be taken into account. * * * I cannot but think, that the same hand which rapidly and safely completes the flap incision, would with almost equal facility, if equally well trained, accomplish the circular." (pp. 151, 52.) And I also agree with him, that "the comparative extent of cut surfaces in the respective operations seems of trifling import; a few inches more or less, provided always that a good stump is left, will never determine the issue of an operation." (p. 152.)

FERGUSSON also remarks, in reference to amputation through the calf of the leg and at the shoulder-joint, that "in either of these cases, and whether the operation has been by flap or by circular wound, the stumps are at last so much alike in certain parts of the body, that it is occasionally difficult, after the lapse of years, to say whether an amputation has been by one mode or the other; at all events when such distinction can be drawn from the shape of the cicatrices, it is evident that the end of the bone is covered by much the same thickness of soft parts in one instance as in the other. If there has been a full fleshy stump shortly after the operation, all muscular fibre has at last disappeared, and the skin with a substance resembling condensed cellular texture, alone covers the bone." (pp. 153, 54.) The correctness of these observation must be fully admitted, as must also that "this substance, undoubtedly, gives great protection to the end of the bone, and its presence is absolutely necessary," (p. 154,) not, however, as "a useful support for an artificial limb," as LISTON states, for in no case, if an artificial limb be properly adjusted, does it bear on the end of the stump; but if it be made to do so, it may be pretty certainly expected that the part exposed to pressure will ulcerate, and this perhaps be followed by exfoliation of bone.

So far as my own experience proves, flap-operations in the continuity of the bone may be performed as successfully as circular operations on every limb but the leg, in which

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(*a*) Above cited.

the calf muscles are so bulky, that it is often difficult to get the skin well over them, if they be left, and I do not think the cure is so quick as with the circular. But if a skin flap be made and the muscles cut through directly, I do not think more time is gained than by the circular operation. There is, however, a more serious objection to flap-amputation through the calf, in the greater frequency of after-bleeding; this has occurred to me two or three times, and the number of vessels I have had to take up and the sloughy condition of the whole one, and its tedious union by granulation have almost induced me to determine never to operate on the leg but with the circular.

On any other part, I believe it is of little consequence which of the two operations is performed. Some Surgeons have been accustomed to practise one and some the other mode, and thus having acquired experience, preferred their own method. I have employed both, and shall probably continue to do so, believing, with the exception I have made, that either will answer equally well, provided due attention be paid to the dressing throughout the whole course of the cure, without which all the objections that have been made to either will most certainly be verified.—J. F. S.]

2710. Opinions are divided as to the preference of uniting the amputation wound by quick union, and its cure by suppuration and granulation; the former method has, however, the most supporters, and is, generally, the most proper. As for the rest, many practitioners have exaggerated the evils accompanying the cure by suppuration and granulation. When in this treatment the rules already laid down be observed, the wound not stuffed with lint, and its union not prevented at bottom, but merely at the edges of the skin, according to my experience, the cure proceeds as quickly as with quick union, for the wound after amputation of large limbs never takes place by complete agglutination, in the strict sense of the word. The cure of the wound by suppuration and granulation is specially proper for those cases where the patient has long been subject to ulcers and considerable suppuration, where the quick suppression of the discharge has ill consequences, and translations to the cavities of the body may take place, where issues and other drains are not always able to prevent these evil results (*a*). KLEIN, TEXTOR, and others, have denied these statements.

This is also DUPUYTREN's (*b*) opinion. He considers that dressing of the amputation wound, by which it is at every point closely united, as injurious, as a complete glutination does not follow, and by the collection of the discharge in the bottom of the wound, injurious consequences ensue. He collects all the ligatures into a bundle, which he carries out at one corner of the wound, and if this bundle be not sufficiently thick, he increases its size in rare cases, by adding charpie to it. The results of this practice are more favourable than those in which the edges of the wound are completely brought together. Only in amputations required for injuries, and which are at once performed, does he close the wound; in all cases where long continued disease with irritation and suppuration have rendered amputation necessary, the above treatment should be had recourse to, as with complete bringing together, inflammation of internal parts, specially of the belly, may occur.

[Among English Surgeons there is no difference of opinion, as to the mode in which union of an amputation wound is to be attempted. In all cases it is endeavoured and hoped to produce quick union, whether by sticking plaster or by sutures and linen dipped in cold water. The object is to promote adhesive not suppurative inflammation, as the patient's constitution suffers less from the former than the latter, and the cure is infinitely quicker. The fear of *metastasis* in consequence of the sudden checking of a drain upon the constitution, by the removal of a limb having a large ulcer upon it, or in a case of compound fracture or other injury where the discharge is profuse, is amongst English Surgeons little thought of, as their experience proves it to be, except in very rare cases, without foundation. And the usual rallying of the patient's powers after the amputation of such limb, which at once puts a stop to the drain on the constitution, and relieves the irritation of the nervous system affords no inducement to follow DUPUYTREN's practice of establishing another after getting rid of one suppurating

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(*a*) RUST, Ueber die Amputation grosseren Gliedmassen; in his Magazin, vol. vi. p. 337.
(*b*) Above cited, p. 417.

wound. Experience as to success is the only way by which the correctness of practice can be proved, and the results of English practice in regard to amputation will prove its superiority, if fully carried out, and the necessary and only necessary, dressings for keeping the edges of the wound together, be employed, without swathing in rollers and cross bandages, and even in woollen nightcaps, which in my earlier days I have seen, employed. the only effect of which is that they encourage the suppurative and discourage the adhesive process.—J. F. S.

OF THE RESULTS OF AMPUTATION.

This is a subject of the highest consideration to the Surgeon as regards his decision on the performance of this operation, and his expectation of the success resulting therefrom. **Benjamin Phillips** (*a*) has given a highly interesting paper on this very serious topic, and the result of his inquiry is, that the mortality after amputation in France. Germany, America, and England together, is $23\frac{7}{16}$ per cent.

Dr. **Lawrie** (*b*) has also occupied himself with the same important matter, and draws his conclusions from a series of 276 cases of amputations of all kinds. performed in the Glasgow Infirmary; from which it appears there were 176 recoveries, and 100 deaths, or a proportion of deaths to recoveries as 1 to 1·76.

Potter (*c*) about the same time gave to the Medico-Chirurgical Society an account of the amputations performed in University College Hospital, from June 1835 to January 1841, amounting to 66, with their results, among which there were only 10 deaths, and three of these were among 10 cases of primary amputation for accident.

I now give a brief account of 54 amputations which I performed between the years 1835 and 1840 inclusive, at St. Thomas's Hospital; some particulars, of which I shall give more at length, after the description of the several amputations:—

———		Lived.	Died.	Total.	
Through the Thigh . . .	28				
For Accidents, Primary	. .	. .	5	5	
———— Secondary . . .	. .	1	1	2	
Scrofulous Diseases of Knee . .	. .	13	4	17	
Other Diseases	. .	4	. .	4	
					28
Through the Leg . . .	14	. .	. .	. .	
For Accidents, Primary	. .	6	3	9	
Other Diseases	. .	5	. .	5	
					14
Through Upper-Arm . .	6	. .	. .	. .	
For Accidents, Primary	. .	5	. .	5	
———— Secondary . . .	. .	1	. .	1	
					6
Through Fore-Arm . .	5	. .	. .	. .	
For Accident, Primary	. .	1	. .	1	
Other Diseases	. .	4	. .	4	
					5
Through Shoulder-Joint . .	1	1	. .	1	1
	54	41	13	. .	54

The result of these cases is pretty much the same in general at St. Thomas's Hospital, and putting these together with the cases at University College Hospital, it must be evident, that the mortality is a long way below the 50 to 75 per cent. which has been stated, by some surgical writers, as the ordinary average of fatal amputations. It will be observed also that the largest mortality is among the cases operated on for accidents, and on the lower extremities. In 7 amputations through the thigh, I lost 6; and of 9 through the leg, 3 died. Whilst of 6 primary and 1 secondary amputations in the upper

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(*a*) Observations arising out of the Results of Amputations in different Countries; in London Medical Gazette, vol. xxii. p. 457. 1838.

(*b*) On the Results of Amputation; in London Medical Gazette, vol. xxvii. p. 394. 1841.

(*c*) Results of Amputations at University College Hospital, London, statistically arranged; in Medico-Chirurgical Transactions, vol. xxiv. p. 159. 1841.

extremity, not a single case was lost. This excess of mortality in operating after accidents, is to be ascribed, when the patients die early, to the conjoined shock of the accident and operation. Besides which the persons admitted into hospitals for such injuries are commonly free livers with broken down constitutions, the like of whom are not unfrequently destroyed by the results of trivial accidents, which run either into erysipelas, or diffuse cellular inflammation and gangrene.—J. F. S.]

THIRD SECTION.—OF AMPUTATION IN CONTINUITY OF THE SEVERAL LIMBS.

I.—OF AMPUTATION THROUGH THE THIGH.

(*Amputatio Femoris*, Lat.; *Amputation* oder *Ablösung der Oberschenkels*, Germ.; *Amputation de la Cuisse*, Fr.)

2711. In amputating through the thigh, the circular, or flap cut may be practised, the patient being so placed on a table covered with a mattress, that the limbs extend freely beyond its edge, and the trunk be in a posture between sitting and lying. The sound limb should be supported on a stool and held by one assistant. Another holds the diseased limb at the knee-joint in such way that the leg be bent at an obtuse angle towards the thigh, which itself is a little bent on the groin (1). A third assistant compresses with his fingers or with a compressor, the femoral artery on the horizontal branch of the *pubes* (2). A fourth standing on the outside of the thigh, encircles it with both hands, and draws the skin well up so that there shall be no folds (3); and a fifth gives the instruments to the operator (4).

Compression of the artery by an assistant is preferable to the application of the tourniquet, which can generally be only employed when the amputation is performed at the lower third of the thigh; and the place at which it must then be put on is the upper third of the thigh.

[(1) Except when the injury or disease is in the leg, this direction cannot be followed out; therefore, as, at least with us, the greater number of amputations through the thigh are performed for disease in the knee-joint, and that part is commonly fixed, or its slightest movement so agonizing when there is ulceration of its cartilages, that any change of its usual posture is not warrantable, the Surgeon must be content with his assistant merely keeping the limb steady in any position it can be conveniently held. Occasionally, indeed, the leg can only be held on a pillow, and not till the soft parts have been cut through can the knee be grasped to steady the limb, whilst the bone is sawn.

(2) In pressing on the artery at the groin, a very common mistake is to press the vessel down into the thigh, by which it is thrust upon the muscles, and can only be compressed by great exertion on the part of the assistant, and with much unnecessary pain to the patient. The pressure should always be a little inclined upwards towards the belly, and then the artery can be thrust against the bone and with little effort. It is of great importance, that the assistant who is intrusted with this serious charge, should be well up to his business; he should be well satisfied of the position of the vessel, and his capability of commanding it with ease and certainty, and not have to be fumbling about for it during the course of the operation. Having determined this, it is not right that the patient should be subjected to the pressure longer than absolutely needed; therefore having adjusted his hands, which is best done by placing one thumb on the vessel and the other above it, and grasping the sides of the thigh with both hands, he waits till the operation actually commences, and directly the knife touches the skin firmly presses upon the vessel.

(3) This assistant is superfluous, as the operator can himself better retract the skin to the extent he desires, by grasping the thigh with the whole of his left hand.

(4) These preliminary directions may by some be considered superfluous; but they are very far from so, as upon the thorough knowledge of the duty of each assistant, and

his strict attention to that and none other, depends the easy course of the operation. Of this I apprehend no one will doubt, who has had experience in the instruction of students.—J. F. S.]

2712. In *performing the circular operation*, the operator standing on the outside of the thigh proceeds in the following manner. Carrying his right hand, in which he holds a straight bistoury, under the thigh over to its outer side, he places its edge vertically about a finger's breadth above the kneecap, but always according to the thickness of the thigh, about three or four inches below the part where the bone is to be sawn through, and carrying it in a circular line around the whole thigh, at once divides the skin and underlying cellular tissue down to the *fascia lata*. The assistant now again draws back the skin throughout its whole circumference, and the operator makes at the edge thus drawn back some slight cuts, by which the cellular tissue connecting the skin is divided, and the latter can be drawn back two fingers' breadth.

If the skin be not divided at one continuous circular cut, the cut upon the under part of the thigh must be first made, and then from the inner end of this the second is carried over the front of the thigh into the outer end of the first. The mere drawing back the skin just mentioned, is better than separating and making flaps of it. If the larger amputating knife be used for this purpose, the cut will be less regular.

[Notwithstanding CHELIUS prefers the circular cut and simple retraction, I think the skin fits better on the face of the stump, if, after that is done, it be divided about an inch vertically on either side, so as to make a sort of flap. The largeness of the knife is not of much consequence; but the best for the performance of the operation is a heavy-backed knife, which cuts more certainly and correctly. I do not see any necessity for changing the knife, as CHELIUS recommends; one knife ought to be sufficient for the performance of the whole operation.—J. F. S.]

2713. The operator now, sinking on his right knee, carries the large straight amputating knife, which he grasps with his whole right hand, the upper part of the handle resting between the thumb and forefinger, and the rest of it enclosed by the other fingers, beneath the thigh, over to its outside, places its edge vertically at the edge of the retracted skin, and puts the thumb and forefinger of the left hand upon the fore part of the back of the knife (1). He then cuts through first the muscles on the outer side down to the bone, whilst he bears the knife towards himself and downwards, carrying it round in a circle with a firm stroke, and cuts through the muscles down to the bone. At the moment when the knife reaches the back of the thigh the operator rises and finishes the cut, standing. The assistant who had drawn back the skin, now grasps, with both hands in the muscular cut, in such way that the thumb above and the finger below cross, and draw back the superficial muscles, after which those still remaining attached to the bone are divided higher by a circular cut. A third cut is now made in like manner, by which the *periosteum* is also divided. By means of a cleft cloth, the uncleft part of which is placed on the hind part of the thigh, and its ends carried on both sides of the bone to the front, the assistant holds back the muscles, and the bone is sawn through where the *periosteum* has been divided (2).

Cutting through the muscles on the outside of the thigh, whilst the knife is drawn towards the operator and downwards has the advantage that the whole edge is made to act, and that it is not necessary to carry the knife round upon the outside of the thigh, to *throw* it, that is so to change the true position of the hand on the handle of the knife, that the thumb is on the back, and the other fingers on the opposite side of the handle.

[(1) I do not see any particular advantage in placing the fingers of the left hand upon the end of the knife blade; at all events in this country, we are accustomed to use the knife with the right hand only.

I may take the opportunity here of hinting to the young operator, that the knife is not to be, as I have occasionally seen it, forcibly jammed through the muscles down to the bone, and the circular cut completed with the smallest possible quantity of the hind part of its blade. Knives are not chisels, as this practice would seem to imply, but they may be compared to very delicate saws; and as every one knows a saw will only act well, when it moves in a long stroke, just so is it with the knife, of which the cutting part, whether a small portion only, or successive portions of it be used, must be constantly in motion, continually drawn along the part it has to cut, which it will then cut readily, and not violently forced through, as some operator's fancy it very clever to do.

(2) I prefer spreading my left hand over the face of the stump and thrusting the soft parts back, to an assistant's aid with a cleft cloth, whilst sawing through the bone.—J. F. S.]

2714. After tying the vessels and clearing the wound from blood, and drying the surrounding parts, a roller must be applied from the uppermost part of the stump, in descending turns, nearly as low as the end of the bone, for the purpose of drawing the skin and muscles gently together. The wound is now brought together in a vertical direction with strips of sticking plaster, of sufficient length, placed across it; upon these a pledget spread with some mild ointment is applied; a wad of lint and over it a cross bandage, two ends of which come up on the sides, and the others before and behind the thigh, and the ends confined with a circular bandage, a few turns of which are to be passed over the face of the stump.

[The roller first and the straps of sticking plaster after, with one strap passing over the whole length of the wound, and a circular strap to confine the ends of the straps, are all that are requisite. No wad of lint, cross bandage, or second roller are required.—J. F. S.]

2715. *Amputation through the thigh with two flaps* is thus performed. The patient having been placed as for the circular operation, the precautions taken against bleeding, and the assistants stationed as before, the operator standing on the outside of the limb, with the fingers and thumb of his left hand grasps the flesh on the outside of the thigh and draws it outwards. With his right hand he now thrusts a long narrow double-edged knife through the front of the thigh vertically down to the bone, and with its point close to the outside of the bone, still thrusts towards the back of the limb till it penetrate behind exactly opposite where it had entered in front. The knife is now carried further downwards, and its edge being turned a little outwards, cuts through the muscles and skin obliquely. The point of the knife is then placed vertically on the upper (front) angle of the wound, carried down on the inside of the bone to the lower (hind) angle of the wound, and as it descends along the bone, with the edge turned from it, a second flap, like the outer one in size and length, is formed. The length of the flap should be, according to the thickness of the limb, that of three or four fingers' breadth. Both flaps are now drawn back with a cleft cloth by an assistant, and the operator, with a circular incision at the bottom of the wound, divides the muscular parts still remaining attached, and cuts through the *periosteum* where the bone is to be sawn. The dressing is to be performed in the same manner as after the circular operation.

According to LANGENBECK's method, the operator should place himself in amputating through the right thigh, on the outside, and when through the left on the inside of the limb, and first make on the side next him a semicircular cut from the fore to the hind surface of the thigh, through the skin and muscles obliquely down to the bone; he then carries the knife beneath the limb to the other side, places it at the upper angle of the wound, and draws it, in the same way as in the first cut, to the lower angle of the wound, at which part he must take special care to cut through all the muscles. Both flaps are now to be turned back, and with a circular cut the operator divides all the parts still connected with the bone, at the bottom of the wound.

I have stated in reference to this mode of operating (*a*), that carrying two semicircular cuts through a large quantity of muscles as in the thigh, and their exact connexion at the angles, would be difficult, and the cuts likely to be unequal; and I find this opinion rather confirmed than disproved by LANGENBECK's own observation (*b*), that "one who speaks from experience, and *draws the knife through*, instead of *firmly pressing it on*, the parts will *not* allow this;" and that he had "amputated after comminuted fractures through thighs which were as fleshy as such limbs could possibly be, and yet the knife, *drawn lightly along, flew* through down to the bone, and that too at the inner part of the thigh."

[LISTON (*c*) makes his flaps before and behind instead of on the sides as directed by CHELIUS, and I think his the better mode, as the flaps are well kept together by the position of the stump. According to LISTON's directions, "the Surgeon places himself on the tibial side of the right limb, on the fibular side of the left; lays hold of the soft parts on the anterior aspect of the bone, lifts them from it, enters the point of his knife behind the *vena saphena*, in operating on the right side, passes it horizontally through to the bone, carries it closely over its fore part, and brings out the point on the outward side of the limb as low as possible; then by a gentle and quick motion of the blade, a round anterior flap is completed. The instrument is again entered on the inner side, a little below the top of the first incision, passed behind the bone, brought out at the wound on the outside, and directed so as to make a posterior flap, a very little longer than the former. The anterior flap is merely lifted up after it is formed, but now that both have been made, they are drawn well and forcibly back, whilst the Surgeon sweeps the knife round the bone, so as to divide smoothly the muscles by which it is immediately invested. The bone grasped by the left hand, is sawn close to the soft parts, the saw being directed perpendicularly." (p. 384–86.) The same method is also preferred by SYME and FERGUSSON, the latter of whom justly urges (*d*) the necessity, before entering the knife in front, of well elevating the skin and other textures, without doing which the front flap will not have sufficient breadth, more especially if the operation be performed towards the lower part of the thigh. The reason, however, why the hind flap should be longer than the front one is not, as FERGUSSON considers, because the posterior muscles have greater tendency to retraction than the anterior, but because by the position in which the limb is placed after the amputation, the hind muscles being extended are drawn back from the face of the stump, whilst those in front are relaxed and have therefore no disposition to pull away from the stump.—J. F. S.]

2716. In the *amputation through the thigh with a single flap*, which is by many preferred to the double flap, because thereby the wound is more completely covered, and the projection of the bone more certainly prevented, the flap is made from the *outer*, (BENEDICT, TEXTOR, JAEGER,) from the *inner side*, (ZANG, TEXTOR,) or from *behind*, (HEY,) or *before* (BENJAMIN BELL, LE GRAS, FOULLIAY.) A double-edged knife is thrust in one of these directions down to the bone, passed close to it, and thrust out on the opposite side, and then being carried down along the bone, a flap of four or five fingers' breadth is formed. Whilst the assistant holds back this flap, and draws up the skin on the other side, the operator makes a semicircular cut an inch below the part where the knife had been thrust in and out, through the skin, draws it up, and then at the base of the flap divides the muscles with a semicircular cut down to the bone, and through the muscles still remaining attached.

I have only employed this method in those cases where there has been unequal destruction of the soft parts on the one or other side, so as to preserve a larger portion of the limb, especially in the upper part of the thigh.

[Amputation with a flap from behind has been performed by Dr. LITTLE of Sligo County Hospital. FERGUSSON observes, that "after making such a flap, he should cut away a considerable portion of the great sciatic nerve, so that it might not by any chance be brought to lie against the divided surface of the *femur*." (p. 408.)]

(*a*) Heidelberger klinische Annalen, vol. i. part ii.

(*b*) Nosologie und Therapie der chirurgischen Krankheiten, vol. iv p. 312.

(*c*) Practical Surgery.

(*d*) Above cited, pp. 405, 407.

[SYME (*a*) has made the following observations in regard to amputation through the shaft of the thigh-bone:—"The danger immediately attending its performance," says he, "and the inconvenience of its imperfect result, in rendering the stump uncomfortable, have suggested various contrivances and modifications of procedure, with the effect, certainly, of restraining the hemorrhage, diminishing the patient's suffering, and promoting union of the wound. But the stern evidence of hospital statistics still shows, that the average frequency of death is not less than from 50 to 70 *per cent.*, while it cannot be denied that many of the survivors suffer from uneasiness connected with protrusion of the bone. Having from an early period of my practice devoted much attention to the subject of amputation—having seen the circular incision give place to the flap-operation,—and having witnessed the results of these methods, variously modified, in the hands of many Surgeons possessing every degree of operative skill, I am at length led to the conclusion, that there is something radically wrong in the principle of the operation. This error I believe to be, dividing the thigh-bone through its shaft instead of the condyles or *trochanters.* * * * The most frequent occasion for amputation of the thigh is afforded by diseases of the knee-joint. Next to this may be ranked compound fractures of the leg and thigh, and then tumours of the leg and thigh. * * * Dense bone dies more readily than that of a spongy or cancellated structure; and the action of a saw, to say nothing of ruffling the *periosteum*, must always be apt to cause exfoliation, which, by impeding union of the soft parts, delays union, and opposes its perfect completion, by increasing the scope afforded to contraction of the muscles. It would, however, be a narrow view to suppose that the direct effect of local injury is alone concerned in causing death of the bone after amputation, and there can be no doubt, that inflammation of the medullary membrane may co-operate, if it does not act exclusively, in its production. * * * But if the medullary membrane be liable to inflammation, suppuration of its texture, and inflammation of the veins cannot fail to be the frequent consequence. * * * But when the bone is divided through the condyles, nothing more than the *epiphysis* being concerned, the medullary membrane is not at all disturbed, whilst the cancellated structure is not liable to exfoliate, either from proneness to die from injury, or through inflammation of any other texture." (pp. 337–39.) Two cases of scrofulous disease of the knee-joint, in general very favourable cases for amputation, are given as successful examples of the result of this practice, and upon these the recommendation of amputating through the *epiphyses* of the thigh-bone is founded.

In reading the above paragraph, I was surprised at the dangers and inconveniences resulting from amputation, at the middle or near the middle of the shafts of bones which is most commonly selected for that operation, as detailed by SYME; and still more at the awful mortality of from 50 to 70 *per cent.*, which "the stern evidence of hospital statistics still shows." And as my recollection of the usual results of amputation at St. Thomas's Hospital had not led me to consider amputation so formidable an operation, either immediately, or in its consequences, except in the case of primary or secondary amputations for accidents, which are always very serious, and most commonly fatal, I referred to my notes of all the amputations I had performed in St. Thomas's Hospital during six years. From these is subjoined an account of twenty-eight amputations through the thigh; five of them were primary, and two secondary; the whole were fatal except one of the latter: the remainder consisted of seventeen cases of scrofulous disease of the knee-joint, of which four died; two of *necrosis;* one of *osteosarcoma;* and one of fungoid disease, all lived. The total of the fatal cases were ten, or 35·7 *per cent.;* of the primary, all died; of the secondary, 1 in 2, or 50 *per cent.;* of the scrofulous, 4 in 17, or 23·5 *per cent.* In none of the successful cases did any of the untoward occurrences happen which are mentioned by SYME, though all were amputated through the middle of the bone, excepting that in three cases a very small ring of bone exfoliated, and in which only did protrusion occur, and that only for a time. The results of my colleagues' practice in regard to this operation, I am quite sure, correspond with my own, though I cannot report them, but the cases I have given afford a fair estimate of this operation in our Hospital.

An account of eighteen amputations through the thigh by LISTON has also been given (*b*), of which for accidents, two were primary, one lived and one died; and two secondary, one lived and one died; eight were for disease of the knee-joint, one fatal; two for painful stump, one for old ulcer, one for malignant ulcer, one for erysipelas, one for tumour in the ham, all the last six successful. The average of the fatal cases here is 1 in 6, or 16·6 *per cent.*; in the primary and secondary cases, 1 in 2, or 50 *per cent.;* and in the scrofulous cases, 1 in 8, or 12½ *per cent.*

(*a*) Surgical Cases and Observations; in London and Edinburgh Monthly Journal of Medical Science, vol. v. 1845.

(*b*) POTTER, above cited, p. 172–176.

From these facts it may be inferred, that the cause of the awful fatality reecorded must be sought for elsewere than in the damage which the dense bone in the middle of the shaft suffers from the saw; and some better grounds must be found for giving up amputation in the middle of the thigh-bone, and resorting to amputation close to its lower or upper end; in the first forming a stump, which, to the great majority of persons subjected to this operation, either cannot be used, or only with great inconvenience and liability to ulceration; and in the second, forming such a stump as will not permit the use of an artificial leg. How the medullary membrane should be less damaged by sawing through the ends of bones, where it is certainly in larger quantity than in the middle, where it is in smaller quantity, I confess I cannot understand. Hence, I should be little disposed to follow Syme's recommendation, of sawing a little beyond the articular surfaces.

Report of Twenty-eight Amputations through the Thigh, from the Year 1835 *to* 1840 *inclusive.*

	Disease or Accident.	Operation.	Remarks.	Discharged.	Died.
1835					
Ann Quigley, aged 25, admitted June 18.	*Osteosarcoma* of the lower part of the right thigh-bone, of three years' duration.	July 3.	*With circular cut;* five arteries were tied, and the wound dressed at once with straps of plaster; went on well throughout.	Sept. 10.	
Charles Ayling, aged 47 (flour-porter), admitted Oct. 6.	Simple fracture of right leg with comminution and much bruising, consequent on being jammed between a step and a dray-wheel. On *eighth day* the leg became gangrenous; hectic set in and increased.	Oct. 21.	*With circular cut;* in dividing the muscles a large abscess was cut into between the *m. vastus internus* and *biceps;* free venous bleeding; three arteries were tied, but he sunk rapidly.	..	Oct. 21. Seven hours and a-half after the operation.
1836					
Edward Clark, aged 14, admitted Aug. 2.	Ulceration of the cartilages of the right knee-joint with suppuration, and abscess in *bursa* of *m. rectus.* Disease commenced three years since, but has not prevented him walking till the last eight months.	Aug. 19.	*With two vertical flaps;* three arteries tied, and a fourth an hour afterwards. Seven hours after, the flaps were brought together with straps of plaster. On *third day* had a smart attack of irritative fever and great heaviness, which subsided about four days after. The wound healed kindly at bottom, but one flap slipped over the other a little and caused a good deal of trouble.	Nov. 7.	
William Allen, aged 8, admitted Aug. 23.	Sinus leading into left knee-joint; no disease of cartilages. A twelvemonth since sprained the knee; this followed by abscess, which burst a week before his admission.	Sept 3.	*With circular cut;* three arteries were tied. The stump dressed at once with straps of plaster, but did not adhere, became sloughy, a large portion of skin separated, the bone protruded, and the wound healed by granulation; but a ring of bone, about a quarter of an inch deep, exfoliated, and the stump was very conical; but after a few months, as he gained flesh, it ceased entirely to be so.	Dec. 27.	
ohn Ricksett, aged 23 (sailor), admitted Aug. 24.	Ulceration of the cartilages of the left knee with suppuration and sinus, leading down to a large abscess in *m. gastrocnemius,* which opened externally by other two sinuses. Disease commenced two years since, after exposure to wet and cold at sea. In this case the knee was nearly straight.	Sept. 3.	*With two horizontal flaps:* the knife passed through a large abscess in the *bursa* of the *m. rectus,* in making the front flap; this portion of the abscess was dissected out. Five arteries were tied. The femoral vein bled profusely, but ceased on removing the tourniquet band. The flaps were brought together with four sutures and straps of plaster; three of the sutures were removed at *fifty hours,* and the fourth next day. On the *fourth day* was attacked with troublesome cough, followed by bleeding from the stump for some hours, which was stayed by the application of a cold wet cloth. On the evening of the *fourteenth day* he had a smart attack of bilious vomiting.	Nov. 29.	
1837					
Samuel Paddon, aged 29 (sailor), admitted March 17, 1836.	Scrofulous disease of knee-joint.	Feb. 3.	*With two horizomtal flaps.*	March 11.	
1838					
ames Brooks, aged 25, (paper-maker), admitted Feb. 20.	Ulceration of cartilages of left knee-joint. Disease commenced five years since, and two years after received a blow on that joint.	May 12.	*With circular cut,* and the skin divided upwards on each side. The skin retracted, and on the *sixteenth day* the bone protruded through its upper part. Between three and four months after a thin ring of bone separated, but the wound had not healed when he left the house.	Nov. 6.	
oseph Lee, aged 20 (carter), admitted May 26.	Compound comminute fracture of right thigh-bone, with severe laceration of muscles by transit of waggon-wheels.	May 26. Four hours after accident.	*With vertical flaps,* and through the little *trochanter;* the femoral artery tied before the completion of the first flap. Flagged very much during the operation, and lost much venous blood; and though brandy was freely given, he became very low and restless, and with much jactitation, and he sunk rapidly.	..	May 26. An hour and a-half after operation.

	Disease or Accident.	Operation.	Remarks.	Discharged.	Died.
1838 *continued.*					
John Millard, aged 42 (sailor), admitted May 29.	*Anchylosis* of left knee-joint, with severe pain on slightest touch of the knee.	June 2.	*With vertical flaps*; five arteries were tied; lost much blood at the operation, and became very faint; the medullary artery bled very fiercely, but was stopped by pressure. As he rallied bleeding began again, and did not cease till sixteen other vessels, all of small size and much retracted, had been taken up; the medullary artery again burst forth, and was again stopped by pressure. Another vessel was tied two or three hours after, and the bleeding then ceased. The flaps could not be adjusted as at first; next day he complained of pain in his belly; had tightness at chest, and sighed frequently; continued very restless. On the *fourth day* suppuration commenced, and he complained of pain on the outer and under part of the stump; a bread poultice was applied. On the *fifth day* the stump became more painful, and when pressed much pus was discharged from the upper gap of the wound, which was dressed to-day, and he became a little the easier; in the evening the pain in his belly ceased. On the *sixth day*, the pain in the stump, which had diminished, became very severe, and the outer flap was much inflamed, some way up the thigh; he was very restless, and had much constitutional excitement. On the following day he was rather better; but the erysipelatous blush had extended upon the buttock. Has hitherto taken laudanum to allay irritation and give rest, which, however, has not been very effective, and beef tea; the latter of which was to-day changed for a mutton chop and a pint of porter. On the *eighth day* was worse, his tongue coated; pulse very quick and irritable; looks anxious, erysipelatous blush extending to the iliac crest; discharge from wound diminished in quantity, and thinner. On the following morning had some hiccough; looked wild, though perfectly sensible; and had some mucous rattle in his windpipe, which towards evening increased, and the hiccough constant. He continued getting lower, and the breathing worse. Brandy was given to keep him up, and the bronchial affection attacked with blister, and afterwards mercurial friction, but without avail; his bowels got out of sorts, but he went lingering on till the evening of the *twentieth day*. The right *pleura* was found covered with coagulable lymph, and contained four ounces of *serum*, with flakes; both lungs gorged with sero-purulent fluid; the bronchial membrane deep red. The mucous membrane of the stomach thickened and mammillated with brownish-red patches; and that of the intestines, small and large, here and there ulcerated in patches, the stump sloughy.	..	June 2 Twent days af operatio
Charles Russell, aged 28 (farm-servant), admitted Dec. 27.	Severe laceration of the skin of the right leg, and of the *m. gastrocnemius*; consequent on injury by cart-wheel. Was much depressed at his admission.	Dec. 27. Eight hours after accident.	*With circular cut*; four arteries tied; lost much venous blood during the operation, and was much exhausted; wound brought together with a single strap, and the dressing completed twelve hours after. On the *fourth day* irritative fever came on, and he became much excited. On the *sixth day* little union, and free suppuration of the wound, the bone a little protruding. On the *eleventh day* a little graze on the other leg was observed to be separating, and on the *eighteenth* about a pint of pus was discharged from beneath it; subsequently suppuration extended beneath the skin of the whole leg. He improved a little, but afterwards sunk again, complaining the day before he died, of severe pain in the chest. On examination the femoral vein was found filled with pus up to a valve four inches above its cut end. The *bronchi* were acutely inflamed.	..	Jan. 19 Twenty three da after operatio
1839					
William Wilmott, aged 26 (carman), admitted Nov. 6, 1838.	Severe contusion of the right leg, consequent on being jammed between a cart-wheel and the kerbstone; followed by extensive sloughing of the skin of the back of the leg, and suppuration beneath the whole remaining skin of the leg and upper part of the thigh; and great depression.	Jan. 23.	*With circular cut*; lost but little blood during the operation; the femoral artery was tied before sawing through the bone, and other three after. The wound was brought together vertically with straps of plaster. He bore the operation very well, but was sick on being put to bed. From this time he gradually improved, and in *thirty-three days* the wound had healed, and he got up.	May 7.	
James Arnold, aged 22, admitted Aug. 27, 1838.	Soft *anchylosis*, ulceration of cartilages and abscess in left knee-joint. Not much affected constitutionally by the disease, and very urgent for the operation.	April 18.	*With two horizontal flaps*; the soft parts much consolidated, and the flaps turned back with difficulty. Had little arterial, but much venous, bleeding. Five arteries and the femoral vein tied; the latter had bled most pertinaciously. The flaps were at once brought together with adhesive straps. *Next day*, much oozing having taken place, the flaps were opened, a small vessel found and twisted. In the afternoon he began to vomit; another vessel was tied, and the stump dressed. *Third day*, vomiting continued, and at night he wandered much; but on the morning of the *fourth day* he was senseless, continued so for six hours and died. The examination threw no additional light upon the cause of death, which seemed to rest on the constitutional shock from the operation.	..	April 21 Seventy- five hour after operatio
Eliza Phillips, aged 22, admitted April 23.	Soft *anchylosis* of left knee-joint, with constant severe pain, specially at night. The disease began at two years of age. The knee bent at a very acute angle, and very tender.	May 10.	*With circular cut*; six arteries and the femoral vein were tied. The edges of the wound were brought together transversely, and fastened with eight pins and twisted suture; a wet rag applied. The pins removed at *seventy hours*, and union opposite them; dressed with adhesive plaster. In course of a month the wound healed, except a little sinus, where the ligatures had been brought out.	June 12.	

	Disease or Accident.	Operation.	Remarks.	Discharged.	Died.
1839 *continued.*					
dward Moore, aged 27 (tailor), admitted June 4.	Abscesses around, but not communicating with the right knee-joint; synovial membrane thickened, soft, and jelly-like, spotted with red; disease began with a fall sixteen months since.	June 19.	*With two oblique flaps*; eleven ligatures applied. Suffered great agony at operation and for an hour after, on which account forty drops of laudanum given; this quieted him, and the wound was left open for nine hours; two small vessels then tied, and the edges brought together with eight pins and twisted suture; these removed at *sixty-eight hours*, and the edges found generally united; in their place adhesive straps applied. In about a month the wound healed, and the scar began to draw in.	Aug. 27.	
lizabeth Harley, aged 15, admitted May 28.	*Necrosis* in head of right shin-bone, and partial destruction of the joint-cartilages; at other parts the synovial membrane of the three bones adherent at the corresponding surfaces.	June 30.	*With two flaps, oblique, upwards and inwards*; six arteries tied; the stump left open nine hours till glazed, then all remaining clots removed, and another vessel tied; the edges of the wound brought together, and fastened with five pins and the twisted suture; these were removed at *ninety-six hours*, and adhesive straps applied. Some weeks after, when the wound had healed, the scar contracted and drew in, so that there was a cleft appearance of the face of the stump.	Sept. 10.	
narles Walder, aged 21 (labourer), admitted June 5.	Ulceration of cartilages, with suppuration in left knee-joint, and external abscesses not communicating; after a fall two years since.	July 10.	*With two oblique flaps*; in making the front one a large abscess was penetrated, whence much pus escaped; lost much blood, and ten vessels were tied, and afterwards the sac of the abscess was dissected out; flaps left open, and another vessel taken up; nine hours after the clot removed, another vessel tied, and the flaps brought together with seven pins and twisted suture; these were removed at *sixty-nine hours*, but not much union. On the next day his bowels were disturbed, and therefore beef tea changed for arrow root and a little meat; and in the evening had pain at pit of stomach and nausea. On the *eighth day* had a shivering fit. Sores formed on the buttocks, hips, sides of the chest, and shoulders about a month after, most of which healed; but early in October *psoas* abscess appeared in right groin, under which he sunk.	..	Oct. 18.
ary Hutchins, aged 46, admitted Aug. 1.	Fungoid tumour on upper part of calf of left leg, about the size of an orange.	Aug. 21.	*With two horizontal flaps*; thirteen arteries were tied; the femoral was tied two inches above the edge of the flap, but the lower end bled afterwards, and required tying, when the flaps were brought together, ten hours after, with six pins and the twisted suture; these were removed at *seventy-two hours*, and adhesive straps then put on. She went on without a bad symptom.	Nov. 23.	
ames Lee, aged 28 (ostler), admitted May 7.	Ulceration of cartilages of right knee, with sinuses; had had amputation performed through the leg seven years since: two years ago fell and bruised his stump; the knee has swollen since, and abscesses formed about it, during his stay here. These have been opened, and continued discharging.	Oct. 2.	*With circular cut*, and cut on each side of the skin; the muscles did not retract in the least; nine arteries were tied, and the vein also, as it bled very freely; bleeding recurred during the afternoon, and three more vessels were taken up. Did very well, and the wound healed in twenty-six days. Six weeks after had a severe attack of acute rheumatism in the right wrist, and afterwards his heart was attacked; he recovered after a month.	March 17, 1840.	
arah Dowles, aged 50, admitted Oct. 1.	*Necrosis* of right thigh-bone just above the articular surface of condyles, and communicating with sinuses opening above the knee-cap and on the inner condyle. Has had disease in the knee-joint for forty years; but three years ago received a blow on the lower part of the thigh from a boot.	Oct. 12.	*With two oblique flaps*; twenty-one vessels were taken up, and the flaps brought together at once. Recovered, without any untoward symptom.	Dec. 24.	
1840					
dward Berry, ged 13, admitted Dec. 31, 1839.	Soft *anchylosis* of right knee-joint and *necrosis* in head of shin-bone communicating with a sinus.	Jan. 18.	*With two oblique flaps*: nine arteries and the femoral vein were tied; nine hours after the face of the flaps was cleansed, other six vessels tied, and the flaps brought together with adhesive plaster.	March 17.	
illiam Parker, ged 27 (labourer), dmitted Jan. 22, 40.	Compound fracture of left leg, with simple fracture of left thigh, and severe laceration of the skin over, but not communicating with it; consequent on having been run over by a steam-carriage whilst fallen on the rail yesterday, at 6 P.M.	Jan. 22. Twenty-two hours after accident.	*With two vertical flaps*; the femoral artery was tied immediately after making the inner flap; afterwards the femoral vein, the deep femoral, and two small arteries. He did not lose two tablespoonfuls of blood; but the operation depressed him considerably; and he sunk rapidly.	..	Jan. 22. Three hours and a-half after operation.

	Disease or Accident.	Operation.	Remarks.	Discharged.	Died.
1840 *continued.*					
Samuel Armstrong, aged 16, admitted March 24.	Ulceration of cartilages, with suppuration and adhesive deposit on synovial membrane of right knee-joint. Much out of health.	March 28.	*With two horizontal flaps;* three arteries tied, but the medullary artery oozed freely, except when stopped by pressure; the flaps brought together four hours after with adhesive plaster. On the *fifteenth day* irritative fever came on, with much head-ache, and could not be checked.	..	April 29 Thirty-two days after operation
Hugh Evans, aged 20 (sailor), admitted May 2.	Compound fracture of left leg, with severe laceration of muscles, and simple fracture of same thigh into the joint, consequent on timber falling upon the limb. Had lost much blood.	May 2. Three hours and a-half after accident.	*With two horizontal flaps;* four arteries were tied. The wound was sloughy, but had cleared on the *eleventh day*, up to which time he had been tolerably well. On the *thirteenth day* was attacked suddenly with pleuritic symptoms, and the *sputum* slightly tinged with blood; some little cessation of these symptoms occurred, but he sunk. The left *pleura* contained straw-coloured *serum*, with flakes of coagulable lymph, and both costal and pulmonary surfaces covered with lymph; the lower lobe of left lung infiltrated with pus; its apex consolidated.	..	May 20. Eighteen days after operation
Henry Parker, aged 43 (brewer's servant), admitted June 1.	Compound fracture of the left thigh, with laceration from the inner condyle to nearly the *pubes*, but not much bruising: laceration of right hand and dislocated metacarpal bone; consequent on transit of a loaded dray-wheel. Much depressed on his admission.	June 1. Four hours after accident.	*With two flaps;* immediately on making the first he was violently sick, and I tied the femoral artery before making the second. Some other arteries tied; an hour after operation was violently sick, and once after. *Four hours* after the flaps brought together with three sutures and straps of plaster; vomited again during the night. *Twenty hours* after the first operation, amputation through the wrist-joint, with a flap from the back of the hand, and five ligatures applied. Sutures in thigh removed *after one hundred and eighteen hours;* the wound sloughy. On *seventh day* attacked with irritative fever, and on the day following was much purged, and this continued till he sunk. On examination there were found a little lobular *pneumonia*, principally in left lung; some ulceration of mucous membrane of intestines.	..	June 14. Thirteen days after operation
Robert Richards, aged 15, admitted June 16.	Soft *anchylosis* of right knee. Disease began nine years since after a fall.	July 25.	*With horizontal flaps;* six arteries tied; the wound brought together with a single strap, and the dressing completed eight hours after. On the *fifth day* the bone began to protrude, and could not be replaced, but the wound healed, excepting immediately around it, in course of six weeks; and at the end of two months a little ring of bone separated; the wound had not completely healed when he left.	Oct. 20.	
Benjamin Scott, aged 9, admitted June 9.	Soft *anchylosis* of left knee. Disease began five years since, without known cause.	Sept. 19.	*With circular cut;* four arteries and the femoral vein were tied; the edges of the wound brought together with a single strap, and the dressing completed seven hours after; went on without a bad symptom.	Dec. 15.	
James Vinson, aged 35 (farm-servant), admitted Aug. 18.	Ulceration of cartilages of right knee-joint, adhesive deposit on the synovial membrane; the joint full of pus; and the *bursa* of the *m. rectus* full of pus. Originated in a blow with a shovel nine years since.	Nov. 14.	*With circular cut;* the muscles did not retract; and in dividing them, the abscess beneath the tendon of the *m. rectus* was cut through, but the part on the stump was left; nine arteries were tied; he was much exhausted by the operation, and passed his motions involuntarily; the wound was brought together at once with adhesive straps; the stump was perfectly healed in three weeks.	Feb. 2, 1841.	
John Pearman, aged 19, admitted Nov. 10.	Soft *anchylosis* of the left knee; abscess above the head of the shin-bone; the remaining joint-cartilages ulcerated.	Dec. 5.	*With the circular cut;* six arteries and the femoral vein were tied; the edges of the wound were at once brought together with adhesive straps, but three hours after bleeding recurred, and four more small arteries were tied; the wound was dressed as before; went on very well for a fortnight, and then the stump became sloughy, but it cleared in a few days.	Feb. 2, 1841.	

[Since the last sheet has been worked off, I have met with another paper of SYME's on amputation of the thigh (*a*) which I had accidentally overlooked, in which, after having advocated since 1823 the superiority of flap-amputations over those by the circular cut, he now states :—" When the flaps are placed together it seems as if nothing could prevent their perfect union so as to effect a speedy cure, and afford a comfortable covering to the bone. In some cases these favourable anticipations are fully realized; but though a good many days, and even one or two weeks, may elapse without making manifest the disappointment to be experienced, it much more frequently happens that the soft parts, however ample they may have appeared in the first instance, gradually contract and diminish until care is required to keep their edges in apposition over the bone, which sometimes, notwithstanding every precaution, at length becomes denuded,

(*a*) Monthly Journal of Medical Science. Nov., 1846.

and presenting itself to view, whether dead or living, proclaims the unavoidable misery of a sugarloaf stump. This distressing result depends upon the vital contractility of the muscular tissue, which continuing in operation so long as the cut surface is not prevented from yielding by the formation of new adhesions, not only lessens the mass of flesh provided for covering the bone but gradually retracts it together with the superjacent integuments." He thinks that this effect is, among other circumstances, caused by amputating through the lower third of the thigh, and has, therefore, for many years recommended amputating through the middle of the thigh in preference, "to prevent the great risk or almost certainty of protrusion to which the bone is exposed when divided at or near its lower third." He then compares the result of amputation with the circular cut through the lower third of the thigh, "which being the thinnest part of the limb, most readily admits of forming a stump composed only of skin," and then directs that "the incision of the skin should be made as near the knee as possible, not in a circular direction but so as to form two semilunar edges, which may meet together in a line from side to side without projecting at the corners. The *fascia* should be divided along with the integuments, which are thus more easily retracted—not by dissecting and turning them back, but by steadily drawing them upwards through means of the assistant's hands firmly clasping the limb. This should be done to the extent of at least two inches or more if the thigh is unusually thick. The muscles are then to be divided, &c." (p. 223-25.)

These remarks from so able a Surgeon as Syme, cannot be passed by without notice, as they might lead the inexperienced to fear operating with flaps in the lower part of the thigh, whilst in reality there is nothing to be dreaded. I have always been accustomed to amputate as low as possible through the thigh, not that the patient might rest on the end of his stump, which is not to be permitted, but simply to give the socket of the artificial leg a better grasp, and I certainly never had a permanently protruding bone nor a conical stump. Indeed, so far as I have had opportunity of seeing amputations through the thigh, either by the circular cut or by flaps, in London practice, conical stumps are rarities, and I am certain that within the last thirty years, I have not seen half a dozen, and I am convinced that when they do occur, except in the comparatively few cases of sloughing of the stump, even in which they are rare, they are produced, not by the mode of operating, but by want of proper attention to the after-dressing. Indeed I have seen again and again, in olden time, after amputations in which both skin and muscles had been so badly cut, that with all the operator's efforts it was impossible to make the edges of the wound meet by a finger's breadth, and the more he endeavoured, at first, to close the wound and cover up the bone, the more pertinaciously it stuck out, and would not be covered; yet notwithstanding, I have been again and again surprised at finding towards the end of the treatment, as good a stump made as if the operation had been ever so well performed; the whole secret of which was that the after-treatment was most sedulously attended to. As to "steadily drawing the integuments upwards, not by dissecting and turning them backwards, but through the means of the assistant's hands," I have only to observe that in scrofulous disease of the knee, in most cases, this cannot be done, as the cellular tissue is completely glued up and fixed with the adhesive deposit in it, and will not move; neither in case of accidents with large fat thighs, will the cellular tissue yield to any thing like this extent; and it can alone be effected in thin persons of loose fibre, and then only when the disease is of the leg, and not of the knee.

With regard to amputating through the *epiphyses*, which not long since he had warmly inculcated, Syme now says, in this same paper:—"As the soft parts required to form the stump in this situation (amputation at the knee) are apt to be so deranged in their texture as to delay, though not prevent recovery, and thus in some measure, counterbalance the advantage of exposing cancellated, instead of dense bone, together with the contents of its medullary cavity, I do not persist in advocating amputation at the knee. now when satisfied that the operation by circular incision, if performed with due care, on proper principles, may be employed at the lower third of the thigh safely and advantageously (p. 225.) Is not this in fact giving up this much-praised operation?—J. F. S.]

II.—OF AMPUTATION THROUGH THE LEG.

(*Amputatio Cruris*, Lat.; *Amputation des Unterschenkels*, Germ.; *Amputation de la Jambe*, Fr.)

2717. If the disease which renders amputation through the leg necessary, permit, it may be performed *above*, *below*, or *through the calf*; in poor persons, however, the best place is three fingers' breadth below the tubercle of the shin-bone, as with the shortness of the stump, it easily bends back, and the knee becomes the point of support on the artificial limb. The amputation may be performed with the circular cut, or with one or two flaps.

2718. The position of the patient is the same as in amputating through the thigh. The tourniquet must be so applied immediately above the knee-cap, that its head may directly compress the popliteal artery (1), and it is intrusted to an assistant. Two other assistants support the leg horizontally, and moderately bent at the knee, the one grasping above the foot and the other below the knee, and the latter at the same time draws up the skin moderately tight. The operator should always stand for this operation on the inner side of the leg.

[(1) The application of the tourniquet as here directed, is highly objectionable, for it must make violent pressure upon the popliteal nerve, and cause much unnecessary pain. It should be put on immediately above the middle third of the thigh, and its pad should rest on the femoral artery, where it lies close against the inside of the thigh-bone.—J. F. S.]

2719. In the *amputation with the circular cut*, the operator makes the skin cut, two or three fingers' breadth, according to the size of the limb, below the part where he will have to saw through the bone, in the same manner with the straight knife, as in amputating through the thigh (1). He then with his left thumb and forefinger takes hold of the edge of the skin, draws it a little up, and with sufficient strokes, separates together the whole fat and cellular tissue, all round from the *fascia* up to the place where the limb is to be removed; the detached skin is then turned inside out, and so kept by an assistant. The operator now grasps a straight long amputating knife with his right hand, and sinking down on one knee, carries it beneath the limb over to the inner side, places its edge close to the edge of the retracted skin, and putting the left thumb and forefinger on the fore part of the back of the knife, with proper pressure bears the knife towards himself and downwards, draws it circularly round the limb, rises up, and cuts the muscles through to the bone. He then takes a narrow double-edged knife (or catlin) so that the thumb rests on that part of its handle corresponding to the edge, and the fore and middle fingers on that to its back, passes it under the limb, and places its edge, near the junction of the blade with the handle, upon the front of the shin-bone, carries it over the spine, and then with the point of the knife always following the bone, thrusts it from without into the interspace between the bones, down to the handle. He now drops the edge of the knife upon the splint-bone, draws it, without leaving that bone, up out of the interosseal space around the hind surface of the splint-bone, and then thrusts it on the inside through the same space up to the handle, bears it against the shin-bone, and again withdraws it upon that bone. In this way all the parts between the two bones and the *periosteum* are cut through. Care must be taken in doing this, that the point of the knife be not again pushed through the already divided muscles. The muscles are now held back with a three-headed cleft cloth, of which the uncleft part is placed on the inside of the limb, and held by an assistant, the middle head passed between the two bones, and then laid on the front of the leg, and the inner and outer head so drawn together over the surface of the wound on the inner and outer side, and crossed with the upper part of the middle head, that all the muscles may be covered. The assistant now holding the cloth properly drawn together, the operator places his left thumb on the edge of the shin-bone near the place where it is to be cut through, forms first a groove with the saw in the shin-bone, sufficient to determine its track, and then drops the saw in such way that the splint-bone may be cut through before the shin-bone.

Amputation through the leg in its lower third was preferred by the Surgeons of old; and even up to the present there are some who defend its performance at this place, as on account of the smaller size of the soft parts and of the bones, the operation is less important and dangerous, the wound heals more quickly, and a well-constructed artificial foot can be more easily worn. But this latter point has been directly denied by many Surgeons; and on account of the price and of the frequent necessary repairs of such artificial feet, this place of amputation is fit only for the rich, and on account of the smaller wound for old persons. The ordinary mode of amputation with the circular cut is here objectionable, as it is always difficult to dissect back properly the pretty thick and adherent skin, and to turn it up for the purpose of cutting through the circular part of the limb. The skin also easily mortifies, or a badly-covered stump is formed. The formation of a hind flap made, as now to be described, is therefore preferable.

Salemi (*a*) first makes the semicircular cut over the front of the leg and afterwards the flap cut, by piercing the calf with the knife, which answers no purpose at all.

Or the circular cut should be made according to **Lenoir**'s (*b*) method in the following way:—“ The Surgeon standing on the inside of the limb, makes with a narrow catlin a circular cut through the skin to the *fascia*, about an inch and a half below where the bone is to be sawn through. With the point of the knife he makes a second cut perpendicular to the former, an inch and a half long, along the inside of the shin-bone near its spine. Then holding the corners of the wound, one after the other, he divides the cellular tissue and its connexion with the *fascia* and *periosteum* and forms with them two flaps, which he turns back at their base. These flaps must be made as thick as possible and not extend below the front third of the leg, as the cellular bridges which connect the skin with the underlying parts, must be divided only behind and on the sides. In this way a sort of ruffle is preserved, cleft in front, and of which the front part alone is turned back on the two sides of the shin-bone, giving to this part of the leg an oval shape, which the knife follows in making the first cut through the muscles. For this purpose the operator places the edge of the instrument on the outer edge of the shin-bone, and carries it to the inner edge exactly following the oblique direct of the cutaneous ruffle, cutting through the whole thickness of the superficial layer of muscles at the back of the leg. The assistant now lifts up this muscular layer with the skin covering it, and when they have reached the point where the bones are to be sawn through, the operator makes a second cut, giving it a direction exactly transverse to the axis of the limb, which at once passes through to the deep layer of muscles, and after this he pierces, as usual, the interosseal space and cuts through the *periosteum*. The retractor is then applied, and both bones sawn through at once and in the same plane. After the vessels are tied, the flesh brought over the bone, and held together by a circular bandage moderately tight around the whole limb, the two lips of the vertical wound in front of the shin-bone are brought together with a suture, and the wound converted into the circular amputation wound, which is united in the direction of the antero-posterior diameter of the leg. The patient is then put to bed with his limb laid a little on the outside.”

According to **Baudens**, the amputation may be made even through the ankle-joint, in which case one flap is made from the skin of the instep, and the other from that covering the back of the heel and the sides of the ankles, and both ankles and the hind part of the shin-bone must be sawn through (*c*).

When the leg is cut off higher than three fingers'-breadth below the tubercle of the shin-bone, the operation must be performed precisely in the way directed above.

Disjointing the head of the splint-bone is dangerous, on account of the opening of its capsular ligament (*d*); but, according to **Jaeger** and others, this is not to be feared. The operation must not be performed above the tubercle of the shin-bone, as otherwise the insertion of the patellar ligament is cut through, the mucous bag behind it, and even the joint on its sides opened, by which, drawing up of the knee-cap and inflammation of the mucous bag and of the joint ensue. **Larrey** (*e*) has amputated the leg immediately through the articular head of the shin-bone.

[(1) Amputation through the leg should be performed not more than four fingers'

(*a*) Des Inconvéniens de l'Amputation de la Jambe au lieu d'élection. Paris, 1825.

(*b*) Archives générales de Médecine. 1840; vol. viii. p. 263.

(*c*) **Bourgery**, Traité complet de l'Anatomie de l'homme, comprenant la Médecine Opératoire, vol. vi. pl. 83.—**Froriep**, above cited.

(*d*) **Zang**, Operationen, book iv. p. 170.

(*e*) Mémoires de Chirurgie Militaire, vol. iii. pp. 56, 389.

breadth below the apex of the knee-cap, in working persons, on whom the operation is most commonly performed, as the kneeling posture in the bed of the wooden leg is the best and most useful for them: and if the stump be of greater length, its only use is to be in the way and be liable to injury. In persons of easy circumstances, who can afford to be idle, and are not required to be always a-foot, a long stump, by amputation a little above the ankle, if possible, which is not always, may be permissible; and they will enjoy the movements of the knee-joint; but for useful purposes, gentle or simple, will find the short stump the best: for it must be remembered, that in no properly-fitting artificial leg is the weight of the body thrown upon the end of the stump, as some Surgeons pretend it ought to be, forgetting if it be, that a sore stump is generally the consequence.—J. F. S.]

2720. Tying the vessels is performed in the usual manner, but is often difficult when the amputation is performed high up, because the vessels are here collected together in a bundle. If the nutritious artery of the shin-bone bleed violently, a little ball of wax must be thrust into its mouth (1).

When the vessels are tied, the ligatures arranged, and the circumference of the wound dried, the edges of the skin must be brought together vertically (2), and kept in this position by strips of sticking plaster, not too tightly applied. A wad of lint and a compress are applied, and lightly fastened with a roller. The position of the stump must be either outstretched or bent at the knee, according as it is intended to preserve the movements of the knee in the application of an artificial leg, or to let the maimed person go upon the knee. The after-treatment must be directed according to the general rules.

Although in the above-mentioned mode of amputating through the leg, the skin merely is preserved to cover the stump, I have always found it sufficient, and have never noticed any protrusion of the bone. I have never seen the skin become gangrenous and burst through by the pressure of the sharp end of the shin-bone, and I therefore consider the recommendation of sawing it off obliquely, useless and superfluous (3).

[(1) One of the most troublesome circumstances, in regard to tying the vessels in amputating high up through the leg, is when the anterior tibial artery has been divided just after it has passed through the interosseous ligament, and retracts so that it cannot be pulled out and tied, but sometimes bleeds fiercely, especially after the posterior tibial artery has been taken up. It must then be managed, either by carefully cutting through the interosseous ligament till it can be got at and tied, which is the best mode of proceeding; or by passing a needle and thread a little above the divided edge of the ligament on one side of the spot whence the bleeding issues, from before to behind, and then bringing the thread back again from behind forwards on the other side of the bleeding point, and tying all contained within the loop, which sometimes answers the purpose. Dipping with the *tenaculum*, and tying all it hooks up, is not advisable, for even if it catch the artery, the ligament is also caught with it, and the ligature cannot be made so tight as to ensure safety from after-bleeding.

I have occasionally seen bleeding from the nutritious artery of the shin-bone very tiresome, but have never seen it require more than pressure for a little time till a clot is formed. If I could not so succeed, I should rather prefer applying the actual cautery than using a pellet of wax, as here recommended.

(2) I do not think bringing the edges of the wound together vertically answers so well as horizontally; for in the former case, the skin is not merely unsupported, as the stump rests on the pillow, but the pressure tends to make the wound gape. I therefore prefer bringing it together horizontally, by which means the hind part of the stump is supported by the pillow, and the fore part readily drops to meet it without any stress, and even relieves the tightness of the dressings.

(3) I cannot say that I have always had CHELIUS's good fortune in regard to the skin covering the sharp end of the shin-bone, as it has happened two or three times in my own practice, and I have occasionally noticed it in the practice of others, that the skin has been pressed on and sloughed. This generally arises from the edges of the wound having been drawn too tightly together, in consequence of the skin saved not being of sufficient length to cover the stump properly, in whatever direction the wound has been brought together; and even when sufficient and the wound has been properly dressed for the first few times, yet occasionally the patient's restlessness and

some times negligent after-dressing will lead to this tiresome result. I therefore think it is better to saw off obliquely merely the projecting point of the bone, which prevents any pressure on the skin, except from great carelessness of the medical attendant in the dressing.—J. F. S.]

2721. *Amputation through the leg with a single flap*, is performed in the following way. The precautions against bleeding and the position of the assistants is the same as with the circular cut. The operator standing on the inside of the leg, places at the part where the bone is to be sawn through, the left thumb on the inner edge of the shin-bone, and the fore and middle finger upon the splint-bone, at the same time pressing the soft parts back to the calf. He now takes in his right hand a narrow double-edged knife, places its point at the part marked by the thumb, on the inner edge of the shin-bone and thrusts it deeply through the skin and muscles, a little obliquely from within outwards and backwards till it rest upon the splint-bone. He then carries the point of the knife close behind this bone, and whilst sinking the handle a little, thrusts it through the outside of the leg, directly opposite the point of its entrance. The knife is now carried far down along the hinder surface of both bones, and then its edge being turned obliquely downwards divides the muscles and the skin. The length of the flap must correspond to the bulk of the leg, it should always be one-third of its circumference. The skin is now to be divided on the front of the leg, half an inch below both corners of the wound by a transverse cut, and separated at the base of the flap, where it is turned upwards, and held back by an assistant, who at the same time properly retracts the flaps. For the purpose of dividing whatever still remains attached to the bones, the catlin is carried round at the base of the flap, exactly as in the circular cut. The doubly cleft cloth is now put on, and the sawing of the bones performed as after the circular cut. When the vessels have been properly secured and the wound cleansed, the flap is laid up over the surface of the wound, and brought close to the edge of the skin; in which position it is kept by straps of sticking plaster passing from behind to before, and from side to side. Some turns of a roller are made about the stump, the flap covered with lint, a cross bandage applied over the stump, and its ends fastened with a continuation of the circular bandage, some turns of which are carried from behind forwards over the stump.

In those who have thick calves the knife is not to be thrust close behind the bones, or the flap would be too thick and could not be placed properly upwards. Graefe (*a*) has invented a peculiar knife for this purpose, of hollowing out the inner surface of the flap.

[I have already mentioned (*par.* 2709 note) the reasons on which I object to flap-amputations in the leg, and why I think the circular operation should be preferred.—J. F. S.]

2722. *Amputation through the leg with two flaps* was first proposed by Le Dran (*b*), under the notion that two wounded surfaces applied to each other would take on a quicker union; it has been several times performed by Roux (*c*); Klein (*d*) also proposed and Weinhold first practised it in Germany.

2723. Amputation through the leg with two flaps is not without difficulty, in consequence of the unequal disposition of the soft parts on the two sides of the calf, and of the unequal size and not parallel position of the two bones. No peculiar advantage is obtained from this operation,

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(*a*) Above cited, pl. vii. fig. 4, 5.

(*b*) Traité des Opérations de Chirurgie, p. 568. Paris, 1742.

(*c*) Relation d'un Voyage à Londres, p. 342.

(*d*) Above cited, p. 50.

and it is decidedly less preferable than the circular or than the ordinary flap-cut.

It is performed in the following way. The skin is drawn as much as possible inwards, the double-edged narrow knife thrust in close on the inner edge of the shin-bone vertically in such direction that the point should come out on the back of the leg, rather outwards, and as close as possible to the splint-bone. The knife is then carried down along the bones and forms a flap about three fingers' breadth in length. Both corners of the wound are then drawn as far out as possible, the knife placed in the upper corner, and being thrust in at the outer edge of the shin-bone, so that it runs over the outside of the splint-bone into the lower corner of the wound, forms a second, corresponding in length to the first flap. The flaps being now held back by an assistant, the operator cuts through as in the former manner with the catlin, whatever remains attached to the bones; applies the double cleft cloth and saws through the bones. The dressing is to be performed as in the flap-amputation through the thigh.

If the skin be so firmly attached on the front of the shin-bone that it cannot be removed as directed, a vertical cut must be made into it upon the shin-bone, and the edges of this cut drawn inwards and outwards.

The outer flap may also be first formed by a semi-oval cut, which beginning on the spine of the shin-bone terminates in the middle of the calf, by obliquely penetrating through the skin and muscles, and separates the above-mentioned flap to its base, whilst all the soft parts are carefully detached from the bones. The inner flap is formed by placing the knife in the upper corner of the wound and thrusting it through the lower, and by drawing the knife down from within outwards.

[Liston performs his amputations of the leg with two flaps, "at one of two points according to the circumstances of the patient, the bones being sawn either about midway betwixt the knee and ankle, or close to their upper ends. (p. 379.) The ends of the bone when sawn high, are not exposed to pressure, and then there is less occasion for a muscular cushion. A sort of anterior flap should be made below the knee, but it is short and thin; the principal covering is obtained from behind, and the incisions must be so contrived that the edges and surfaces shall correspond. A proper fleshy cushion cannot be got lower than the middle of the leg. * * * When the right limb is the subject of operation, the point of the knife having been entered on the outside behind the *fibula*, is drawn upwards along the posterior border of that bone, with a gentle sawing motion for about a couple of inches, the direction of the incision is then changed, the knife being drawn across the fore part of the limb, in a slightly curved direction, the convexity pointing towards the foot; this incision terminates on the inner side of the limb, and from this point the knife is pushed behind the bones and made to emerge near the top of the first incision, the flap is then completed. All this is done smoothly and continuously without once raising the knife from the limb. The interosseous muscular and ligamentous substances are cut; the anterior flap is drawn back, and its cellular connexions slightly divided; both are held out of the way by the hands of the assistant, and the separation completed with the saw. By proceeding thus, all risk is avoided of entangling the knife with the bones, or betwixt them. In dealing with the left limb, the proceeding is very similar; the internal incision is not made quite so long; but it should still be practised, for a longitudinal opening of about an inch or more in extent is more easily found in the transfixion, than the mere point at which the anterior incision is commenced. * * * Amputation close to the joint is performed precisely in the same manner; the incisions being made so that the *fibula* is exposed, and sawn immediately below its head, the *tibia* close to the tuberosity. * * * The flap-operation may occasionally require to be modified. When muscular plethoric subjects meet with sudden and severe accidents, which demand immediate amputation, the large quantity of muscle which is necessarily left in the flap is liable to suppurate, to retard very much the patient's recovery, and sometimes to produce dangerous consequences. In such cases I have performed the following operation. Supposing the left leg to be injured, with a common amputating knife an interior semilunar incision is made through the skin, commencing from the inner side of the *tibia*, about four fingers' breadth below its superior extremity, and passing over its anterior aspect. A similar semilunar incision is made at the posterior part of the leg, its extremities joining the bones of the previous incision. The integument is then reflected upwards to a sufficient extent to cover the bones, and the operation finished after the manner of the circular amputation. In fact, this operation differs from the circular only in the form of the incision through the integuments." (p. 379-82.)

Fergusson's mode of operating differs from Liston's in the front flap being shorter. He thus describes it :—" The heel of the instrument (an amputating knife seven inches long) should be laid on the side of the leg furthest from the Surgeon, and the blade should then be drawn across the front, cutting the semilunar flap of skin, until its point come opposite to where the edge was first laid on; without raising the instrument, transfixion should next be made behind the bones, and the rest of the proceedings conducted as in other instances. (p. 398.) In whatever part of the limb the incisions are made, I invariably preserve a semilunar flap in front, varying in length, in different cases from half an inch to an inch. I prefer this to the straight incision across the front, recommended by Mr. Hey, believing that the opposite surfaces will thus fit more accurately to each other." (p. 400.)]

[The ordinary place of amputating through the leg is, as already mentioned, a little below the knee, but formerly the

AMPUTATION JUST ABOVE THE ANKLE

was commonly practised, though now laid aside, and very rarely performed; it however requires some notice.

The Dutch Surgeon, Solingen, advocated the preservation of as much of the leg as possible, and that the amputation should be performed immediately above the ankle; so that an artificial foot with narrow steel plates might be screwed on to the sides of the leg, by which he is able to walk as well as on that which he brought into the world with him. And Dionis (*a*) "is of the same opinion, advising the cutting off a leg as low as possible, provided we find ourselves able to preserve the motion of the knee." (p. 407.) White of Manchester (*b*) also took up this practice in 1761, in consequence of having seen in the previous year "a woman who, twenty years before, had her leg taken off a little above the ankle, by advice of her brother, who was a carpenter, and had promised to make her a wooden leg of his own contrivance. The Surgeon at first refused to amputate it in this place; but being told if he would not, they would apply to another, he consented to do it contrary to his own opinion. The operation was performed by the single incision, and the stump was twelve months in healing." (p. 169.) He mentions nine cases in which he performed this operation, and was fully satisfied of its superiority over the ordinary mode. In his earlier cases he employed a double flap, but afterwards followed O'Halloran's (*c*) mode with a single flap, dressing it and the face of the stump as separate wounds, and not applying the flap till the twelfth or fourteenth day.

Bromfield (*d*) also, from having noticed (about the year 1740) how well a woman walked who had lost both her feet and about three inches of the lower ends of the bones of the leg by frost-bites, in his lectures, recommended "the operation, when made below the knee, to be as nigh the ankle as the nature of the case would admit of." He was, however, induced to withdraw this recommendation from "some eminent Surgeons, assuring him it would be impossible to heal the stump if the amputation was made very low; for the tendons or their *thecæ* would slough, and most likely a second amputation might become necessary." (p. 189.) These absurdities, however, were disproved by some cases in which the operation was performed by a pupil of his, named Wright, first in 1754, which encouraged Bromfield "to put his theory in practice," and "since he received Mr. Wright's papers, he performed the operation many times, and it always succeeded." (p. 192.) How soon Bromfield operated in this way does not appear, but his book was published in 1773, and he there states he had operated "many times." Alanson also followed this method, but applied the flap at once. Hey (*e*), however, disapproved of this practice in consequence of "some cases occurring, in which, from a scrofulous habit, the wound would not heal completely, or remained healed, so that the patient could neither bear the pressure of a socket, nor conveniently use a common wooden leg, (as the length of the leg projecting backwards exposed the stump to frequent injuries,) I determined to try whether amputation in a more muscular part of the leg would not secure a complete healing, and give the patient an opportunity of resting his knee on the common wooden leg, or using a socket, as he might find most convenient." (p. 540.) He therefore amputated through the middle of the leg

(*a*) Cours d'Opérations de Chirurgie. Translation. Edit. of 1710.

(*b*) An Account of a new method of Amputating the Leg a little above the Ankle-joint, &c.; in Medical Observations and Inquiries, vol. iv.

(*c*) A complete Treatise on Gangrene and Sphacelus, with a new method of Amputation.

(*d*) Chirurgical Observations and Cases, vol. i.

(*e*) Practical Observations on Surgery. Second Edition. 1810.

with a single flap from the gastrocnemial muscles, making, as I consider, a very inconvenient stump.

Solingen's operation had thus, in fact, gone completely out of use till, about two or three years since, Lawrence performed it successfully on a young gentleman who had had his foot crushed. Having become acquainted with this, and having a young woman under my care with scrofulous disease of the foot which she did not object to part with, though she was indisposed to lose her leg, I determined to practise it, and accordingly on *March* 9, 1844, I amputated three inches above the ankle-joint with a single flap from the back of the leg with as much muscle as I could get upon the knife, but the principal part of the flap consisted of the Achilles' tendon. Four arteries were tied, and the flap fixed with three sutures and a wet cloth applied for twenty hours, when my assistant removed the sutures and applied straps of plaster. The wound healed very slowly, and had not scarred till after twelve months, when it made a very good stump, and she walks very well on an artificial foot. The course of this case, its tediousness, and the expense of the apparatus satisfy me, though it might be advantageously employed with persons in easy circumstances, that it is not a fit operation for those who have to labour for their living.

In the accompanying report of fourteen amputations below the knee, it will be seen that nine were primary for accidents, mostly very severe, of which two died, and seven survived; the other five operations for disease, in two of which a very small portion of the spine of the shin-bone exfoliated, all terminated favourably, so that the deaths on the whole number was only 14·3 *per cent.*

Liston's (*a*) reported cases of amputation through the leg are twenty; of these two were primary, and two secondary, for accidents, all four recovered; one in whom primary amputation, and a few days after, secondary of the other leg, fatal; nine for scrofulous disease of the ankle, two for disease of the foot, one for *necrosis*, one for *osteosarcoma*, one for ulcerated stump, all which fourteen recovered; and one for ulcer of the leg, who died. Hence the deaths on the whole number were 10 *per cent.*

These accounts do not confirm Lawrie's (*b*) statement that "of the more common amputations, that below the knee is least favourable." Neither do they sustain his rule of practice, "in all cases except those of necessity (not a very comprehensible expression, J. F. S.) to abandon the operation below the knee." (p. 398.)]

(*a*) Potter; in Med.-Chir. Trans., above cited. (*b*) London Medical Gazette, above cited.

Report of Fourteen Amputations through the Leg, from the Year 1835 *to* 1840, *inclusive.*

	Accident or Disease.	Operated on	Remarks.	Discharged.	Died.
1836					
John Johnson, aged 36 (sailor), admitted May 4.	Severe laceration of the muscles of the foot, and the inner plantar artery torn, consequent on leg falling on the fluke of an anchor.	May 4. Six hours after accident.	*By circular cut*; six arteries tied; integuments scanty, and could not be well brought together. Eight hours after, free bleeding, and three more arteries taken up. Except having restless nights, he went on very well till the *fourteenth night*, when the stump was exceedingly painful; and on the following morning about half an ounce of arterial blood was discharged from the wound, but stopped by a little pressure. Next afternoon the bleeding recurred in a jet to four or six ounces; the bleeding part was therefore cleared of clot, but no vessel could be found; no more bleeding occurred till early on the *twenty-second morning*, and then to such extent as to render him faint; and this recurred twice in the course of seven hours, but only in small quantity. The wound was laid open and left till night, when as there was no more bleeding it was dressed. On the *twenty-third day* he bled again; the granulations surrounding the ligature, by the side of which the blood flowed, were separated, and a little cavity, as large as a nut, found lined with a polished membrane; and at its highest part an aperture, as large as a pin-hole, through which the blood flowed. This little sac could not be separated from the surrounding parts, a probe was therefore passed into the hole up the artery, and being felt externally, the skin was cut through, and the artery tied an inch above the face of the stump. No more bleeding after this, and he went on very well.	June 30.	
1837					
John James, aged 52, admitted April 11.	Fungous ulcer on heel, of eight months.	April 28.	*With single flap of m. gastrocnemii*; three arteries tied; much difficulty in securing the anterior tibial, which retracted nearly through the interosseous ligament. The flap brought together with three sutures and straps of plaster; the sutures removed *after forty-eight hours.*	June 20.	

	Accident or Disease.	Operated on	Remarks.	Discharged.	Died.
1837 *continued.* eorge Powell, ged 22 (towing-ope man), admitted June 4.	Severe laceration of lower part of left leg, and crushing of the lower end of both its bones, by transit of train of steam-carriages.	June 4. An hour after.	*With circular cut;* the muscles did not retract at all; three arteries tied; did not lose much blood, but was much prostrated by the operation; edges of wound brought together transversely, and three sutures put in; the latter removed *at sixty-nine hours*. On the *ninth day* the middle of the wound sloughy; and the skin having been pressed on the spine of the shin-bone, had a small gangrenous spot on it; suffered much from pain in the stump. On the *fifteenth day* this had cleared off, but the stump was still sloughy, and the absorbents up the thigh had inflamed. In the evening of this day had severe pain at the pit of stomach, which subsided after cupping. A small bit of bone exfoliated from the spine of the shin-bone.	July 11.	
1838 ames Trussler, ged 27 (excava-r), admitted an. 12.	Compound fracture of tarsal bones of left foot, with large laceration and wound of ankle-joint, by transit of steam-carriage on rail-road.	Jan. 12. Three hours and a-hal after accident.	*With single flap of m. gastrocnemii;* six arteries tied; too much muscle and too little skin, therefore part of the former left protruding, and the rest supported with two sutures and plaster; sutures removed *at forty two hours*, and a small vessel which had continued oozing, was tied. On the *seventh day* the wound was sloughy, and there was slight arterial bleeding; on the *eleventh* a sudden gush of arterial blood, to the amount of half-a-pint, occurred, which depressed him very much; the flap was therefore opened, and a cavity found behind the interosseous ligament, which had been formed by a muscular branch in the flap bleeding into this part when the flap had been brought to its place; it was tied, and the bleeding ceased. On the *forty-seventh day* a small piece of the end of the spine exfoliated.	May 29.	
homas Berridge, ged 44 (ware-ouseman), admitted April 10.	Strumous abscesses in the ligaments of the *tarsus* and *metatarsus*, of seven months' duration	June 2.	*With circular cut;* he suffered excessively during the operation, and in sawing through the bone more than I had ever witnessed. The muscles did not retract; did not lose above two or three ounces of blood; three arteries tied, and edges of wound brought together obliquely with strips of plaster; an hour after very free dripping of blood, and on opening stump five more were taken up; the stump left open, and six hours after three more, after which the wound was brought together with strips of plaster.	Sept. 18	
1839 arnard Lane, aged 54 (porter), admitted Jan. 31.	Compound fracture of the right leg, with protrusion of the shin-bone; consequent on bag of wool falling upon him. On the *second evening* there was slight arterial bleeding, which recurred on the slightest movement, and continued. The wound became gangrenous on the *third day*; and seemed likely to spread, as he was fast hurrying into a typhoid state.	Feb. 2. Midnight Fifty-seven hours after accident	*With the circular cut;* very free bleeding at the operation; three arteries and the posterior tibial vein tied; the wound brought together horizontally with straps of plaster. He improved at first after the operation; but on the evening of the *fourth day* after the operation, became suddenly and violently delirious. On the *fifth* he began to vomit frequently, and the stump was sloughy; next day he was better. On the *eighth day* was attacked with *trismus*, and could scarcely swallow even his spittle; the muscles between the lower jaw and hyoid bone were violently contracted, and the latter forcibly pulled up between the branches of the former. On the *ninth* had some severe spasms about the throat like those of a hydrophobic patient when about to drink. On the *tenth day* became generally tetanic, in which state he continued till death.	..	Feb. 12. Ten days after the operation.
eorge Stilt aged 33 (labourer), admitted March 2.	Compound fracture of left leg, with severe laceration, and the shin-bone protruding, Great depression on his admission.	March 3 Twenty-six hours after accident.	*With circular cut;* lost very little blood; two arteries only tied; wound brought together horizontally, with a single strap of plaster; the dressing completed *four hours* after with plaster. Part of the stripped-up skin had been used for the covering, but this sloughed, as did afterwards the whole of the skin saved; the wound healed kindly by granulation.	May 29.	
ohn Cartwright, ged 52(labourer), dmitted May 28.	Ulceration of cartilages of the tarsal and metatarsal joints of the left foot; consequent on sprain fifteen months since.	June 15.	*With circular cut;* five arteries tied, and two more two hours afterwards. *Ten hours* after the operation the wound was brought together horizontally, and fixed with four pins and twisted suture; these were removed after *fifty-eight hours and a-half;* surface of stump became sloughy.	Aug. 27.	
arah Hattam, aged 57, admitted Sept. 10.	Dry gangrene of toes of right foot.	Nov. 26.	*With circular cut;* four arteries tied at the operation, and four more *seven hours after*, and *in another hour* a ninth, and then the stump dressed with plaster. Free oozing of bloody serum for several days. On the *tenth day* the greater part of the skin covering the face of the stump was sloughy; *ten days* after the line of demarcation became distinct, and healthy pus secreted. The wound afterwards granulated kindly as her health improved, but had not healed when she left.	Feb. 4.	

	Accident or Disease.	Operated on	Remarks.	Dis-charged.	Died.
1839 *continued.*					
Jesse Gooderich, aged 15½, admitted Sept. 20.	Severe laceration of the skin and muscles of the left foot and ankle; consequent on wheel of rail-carriage passing over it.	Sept. 20. Seven hours after accident.	*With circular cut;* six arteries tied; wound brought together horizontally with straps of plaster; no irritative fever.	Nov. 13.	
1840					
James Neal, aged 12, admitted Jan. 18.	Severe laceration of the skin and muscles of the upper part of the calf of the leg and fracture of the *fibula*; consequent on being caught in a tobacco-cutting engine.	Jan. 18. Three hours and a-half after accident.	*With flap from inside of leg;* removed the broken *fibula* at its joint; seven arteries and the posterior tibial vein tied, and soon after another artery was tied; a single strap was put on, and the wound dressed properly *eight hours after*. On *fifteenth day* some bleeding, from one of the ligatures having been dragged accidentally; on the next day bled again, from a little superficial vein, and at each of the two following dressings. One of the ligatures remaining fast, a whalebone spring was put on it on the *thirty-ninth day;* it came away three days after. On the *fifty-first day* some swelling upon the *m. vastus internus*, which he says has been coming on a few days, it fluctuated; was left alone, and filled the whole of the front sheath of the *fascia lata*. On the *hundredth and second day* this was punctured, and a pint and a half of pus discharged. The abscess filled again, pointed at the great *trochanter twelve days after*, and two pints of pus discharged by puncture. A fortnight after, when the discharge of pus had nearly ceased, the upper part of the thigh was attacked with erysipelas, which spread over the loins and back, on the left side of the belly, and did not subside for a week; after this he slowly recovered.		
William Shearing, aged 33 (actor), admitted Feb. 4.	Ulceration of the leg and partial *pes equinus* after compound fracture of the right leg four years since.	Feb. 22.	*With flap of the m. gastrocnemii;* four arteries tied, and bleeding still continuing three hours after, five more were tied, and the face of the stump left open. *Eight hours* from the operation three more arteries were tied, and the wound brought together with straps of plaster. Went on well, but slowly; excepting that one ligature would not come away, and, therefore, on the *forty-seventh day*, a whalebone spring was put on; but two days after the ligature broke off short and remained.	June 16.	
Philip Jas. Punch, aged 14, admitted May 23.	Compound fracture of the right tarsal-bones and inner ankle, with great laceration of the soft parts, and the posterior tibial artery and nerve torn through at ankle; consequent on being caught between the spring and wheel of a locomotive carriage.	May 23. Four hours after accident.	*With circular cut, and side cuts;* two arteries tied; and the wound brought together at once with straps of plaster horizontally.	July 18.	
Michael Daly, aged 38, admitted May 26.	Compound fracture of left leg; the shin-bone comminuted; skin cut clean, but the muscles much lacerated; consequent on locomotive carriage-wheel passing over.	May 26. Four hours and a-half after accident.	*With circular cut and side-cuts;* six arteries tied; venous bleeding great; wound brought together at once with straps of plaster. An hour after, bleeding came on, and two more arteries were tied: but it continued, and *seven hours* after seven other arteries were tied. *Five hours* after, the bleeding continued to the amount of twelve ounces, and three more arteries were tied. The stump was then left open, and not dressed with plaster till *twenty-six hours* after the operation. On the *fourth day* the edge of the skin was sloughy, and the whole face of the stump became so afterwards; on the following day irritative fever set in.	..	June 7. Twelve days after operation.

III.—OF AMPUTATION THROUGH THE UPPER-ARM.

(*Amputatio Brachii*, Lat.; *Amputation des Oberarmes*, Germ.; *Amputation du Bras*, Fr.)

2724. *Amputation through the upper-arm* may be performed with the circular cut or with flaps, and both are performed in the same way as in the thigh. The patient is placed on a chair, and the upper-arm separated from the trunk, so as to form a right angle. If the amputation be performed in the lower third, or in the middle of the arm, the brachial artery must be compressed by an assistant in its upper third. If the amputation be performed in the upper third, the subclavian artery must be compressed above the clavicle against the first rib.

[In amputating through the upper arm it is always advisable to make the stump as long as possible; as thereby an artificial arm is better fixed, and is rendered more useful.

In the accompanying report five of the amputations through the upper arm were primary, and one secondary for accidents; all recovered, but in two of them a narrow ring of bone exfoliated.

Liston's amputations through this limb are seven, of which one was primary for accident and lived; four for scrofulous disease of elbow, of whom two died; one for disease of elbow consequent on burn, and one for senile gangrene, both of whom recovered. Thus, the deaths on the whole number were 28·5 *per cent.*]

Report of Six Amputations through the Upper Arm, from the Year 1835 *to* 1840, *inclusive.*

	Accident or Disease.	Operated on	Remarks.	Discharged.
1835				
Edward Walpole, aged 31 (waggoner), admitted Feb. 9.	Gangrene of fore- and upper-arm, consequent on a blow from a box ten days since on the former. Was fast sinking at the time of operation, in consequence of irritative fever and *diarrhœa.*	Feb. 17. Eighteen days after accident.	*With circular cut through insertion of m. coraco-brachialis;* the parts all so glued together that the skin could not be retracted, but was dissected up. A portion of sloughy skin was included in the cut, which also divided a sinus close to the bone. Four arteries were tied: wound brought together with straps of plaster. Felt better next day, but on *third day* had hiccough, with cold sweats; these, however, soon subsided. On *fourth day* the bone protruded; on the following day was attacked with erysipelas of the ears and face; on the *eighth day* was delirious, but better on the *tenth,* and then steadily improved. On the *thirty-eighth day* a ring of bone was easily removed, and soon after the bone was covered with granulations, which skinned slowly, and the wound had not healed when he left.	April 19.
1836				
James Cook, aged 8½, admitted July 25.	Severe laceration of skin and muscles around the elbow, consequent on receiving the discharge of a carronade close by him. Said not to have lost much blood. The *radius* was fractured, but the brachial artery and elbow-joint were uninjured.	July 25. Two hours after accident.	*With circular cut,* just above insertion of *m. deltoides;* four arteries tied; the brachial exceedingly small; the wound was dressed with straps of plaster four hours after: went on very well, and in a month the wound healed, except opposite an edge of bone which seemed likely to exfoliate, but it did not, and the bone was completely covered before he left.	Sept. 17.
Murtagh Downing, aged 20 (machine boy), admitted Sept. 3.	Compound fracture of the left *olechranon,* with wound into joint, and extensive laceration of the skin and muscles; consequent on having been caught by the drum-strap of a printing-machine.	Sept. 3. Two hours after accident.	*With circular cut* through insertion of *m. deltoides,* but some of the detached skin was used to cover the stump, as there was not enough without. Three arteries were tied, and the wound brought together with three sutures and straps of plaster; sutures removed at *seventy-two hours.* About the *tenth day* there was a little sloughing at the edge of the detached skin.	Nov. 1.
1838				
Daniel Edwards, aged 59 (excavator), admitted Feb. 22.	Severe laceration of skin of the back of the hand, and of adducting muscles of the thumb, consequent on earth-slip falling on him. A fortnight after, great suppuration, irritative fever, and erysipelas came on, which extended above the elbow; sloughing of cellular tissue of fore-arm. Troubled much with cough, and bowels very lax; and he became much exhausted. Bleeding to the amount of two ounces from an artery near the wrist.	April 17. Fifty-four days after accident.	*With circular cut, and two side cuts;* five arteries tied; very little blood lost; three hours after the wound was brought together with straps of plaster; went on well for a fortnight, then flagged, but soon rallied.	June 5.
William Beevers, aged 27 (stoker), admitted Feb. 23.	Extensive laceration of the skin of the right fore-arm, with some laceration of muscles, and the skin separated some distance above the elbow, consequent on being jammed between steam-engine shaft and deck-timbers.	Feb. 23. Nine hours after accident.	*With a flap* of the separated skin, and a circular cut through the muscles, about middle of arm; the muscles did not retract at all; four arteries tied; wound brought together with two sutures; and six hours after, dressing, completed with strips of plaster. sutures removed at *forty-five hours;* the skin sloughed, and the stump healed by granulation.	April 10.
1840				
John Hall, aged 14, admitted Feb. 17.	Compound fracture of the right upper and fore-arm, with severe laceration of soft parts, consequent on cart wheel having passed over the arm whilst fallen on a rail-road.	Feb. 17. Nine hours after accident.	*With circular cut,* in making which, the muscles had been separated beneath from the skin, burst out, and became tightly girt by it; three arteries were tied; a single strap put on, and the dressing completed with straps of plaster twelve hours after. On the *fourth day* part of the skin covering the stump was sloughy, and afterwards separated; the bone protruded, and about two months after the operation a narrow ring of bone was removed.	April 28.

IV.—OF AMPUTATION THROUGH THE FORE-ARM.

(*Amputatio Antebrachii*, Lat.; *Amputation des Vorderarmes*, Germ.; *Amputation de l'Avant-Bras*, Fr.)

2725. The fore-arm may be amputated *with the circular cut*, *with two* or *with one flap*. The patient either sits on a chair or lies near the edge of his bed. The brachial artery is compressed by an assistant, or with a tourniquet, in the middle of the upper-arm; the fore-arm held by one assistant at its lower, by another at its upper part horizontally, and in a position between pronation and supination; the latter assistant at the same time drawing back the skin moderately tight. The operator places himself on the outer side for the right, and on the inner side for the left arm.

2726. The practice *with the circular cut* is precisely the same as that for amputation through the leg. Both bones must be sawn through at once.

Amputation *with a single flap* is performed with the flap on the inner (front) surface of the arm. At the part where the bone is to be sawn through, the narrow double-edged knife is to be placed vertically upon the *radius*, and whilst with the fingers of the left hand the skin and muscles are drawn inwards (forwards), the knife is passed vertically on the inside (front) of the bones, so that its point may project on the ulnar side, directly opposite the point of entrance; it is then carried down along both bones, and with its edge inclined outwards (forwards) cuts out. The length of the flap must depend on the thickness of the fore-arm (*par.* 2721.) Upon the back of the fore-arm and a finger's breadth from the two angles of the wound, the skin is to be cut through with a transverse cut, dissected back to the angles, and the operation completed as in the flap-amputation of the leg.

If two flaps be made, the first is to be formed as just mentioned, the knife is then placed in the upper angle of the cut, carried on the outer (hind) surface of the bones into the lower angle and then forms a second flap corresponding to the first in length. Both are then held back, so that whatever remains attached to the bones, and the interosseous membrane, may be divided as in amputation of the leg. The doubly cleft cloth is then applied and the bones sawn through.

In amputating through the fore-arm there should be, as through the leg, sufficient skin to cover the ends of the bones completely.

After the circular cut, three or four ligatures are usually sufficient for tying the vessels, and of these, the interosseal artery requires the pressure on the brachial artery to be relieved, so that its mouth may be seen.

In single flap-amputation tying the vessels is more tiresome, and with two flaps even eleven arteries may be tied (*a*).

[Not unfrequently in flap-amputations through the fore-arm, the muscles retract less than the skin after division, and consequently the tendons are often left projecting and cannot be properly got in, on closing the wound. When this happens, as it does most usually in the lower third of the fore-arm they should be shortened about an inch with the knife. It must also be recollected, that the ends of the radial and ulnar arteries are to be looked for at the edge of the front flap, and sometimes the muscles will have retracted from them so much that they actually stand out, and for the moment may be mistaken for little tendons.

Amputation through the fore-arm should always be made as near the wrist as possible, so that the socket of any kind of artificial hand may have better hold.

The amputations I have performed through the fore-arm were only five: of these one was primary for accident, and four for scrofulous and other diseases. I have not here

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(*a*) KLEIN, above cited, p. 46.

included another amputation through the fore-arm for accident, as the patient, *Henry Parker*, has been already mentioned (p. 914) among the fatal cases of amputation through the thigh. This second operation was performed twenty-six hours after the accident.

Liston's cases were six, of which four were for scrofulous disease; one for encephaloid disease of the hand; one for painful stump, all of which recovered.]

Report of Five Amputations through the Fore-Arm from the Year 1835 *to* 1840 *inclusive.*

	Accident or Disease.	Operated on	Remarks.	Discharged.
1837 Samuel Winter, aged 68 (labourer), admitted June 20.	Scrofulous disease of right wrist-joint, of eighteen months.	July 21.	*With two flaps just above m. pronator quadratus;* three arteries were tied, and the flaps brought together with three sutures and strips of plaster. In the evening felt severe smarting in the stump; became sickish, and constantly retching; about four hours after vomited profusely, and the smarting subsided. Sutures removed at *forty-four hours.*	Sept. 9.
1838 Thomas Young, aged 42 (waterman), admitted March 24.	Contraction of the muscles of the hand and fingers after diffuse cellular inflammation, nine months since	March 31.	*With two flaps;* two arteries tied, flaps brought together with four sutures and straps of plaster, sutures removed at *forty-six hours.* Attacked with vomiting on *third day*, but not continued. On *fourth day* stump attacked with erysipelas, which subsided after two days. On *twenty-sixth day* a whalebone spring applied to the remaining ligature, which would not come off, and after wearing for ten days it was pulled out.	May 8.
1839 Henry Brewer, aged 36, admitted Sept. 10.	Scrofulous ulcers on right hand, with stiff fingers Disease first showed itself twenty-one months since.	Oct. 10.	*With two flaps;* five arteries were tied, and the wound brought together with straps of plaster; but free oozing continuing, it was opened again, and two more arteries were tied; the dressing left for a few hours.	Nov. 16.
1840 Benjamin Neal, aged 15½, admitted Jan. 17.	Compound fracture of the first three metacarpal bones, and severe laceration of the skin and muscles.	Jan. 18. Twenty-four hours after accident.	*With two flaps;* four arteries tied; the flaps brought together with straps of plaster five hours after.	March 3.
William Dodds, aged 35 (tailor), admitted May 19.	Medullary *sarcoma* of right *radius;* first commenced four months since.	July 18.	*With two flaps;* five arteries were tied; the venous bleeding very free, as the veins were very bulky. Flaps brought together with plaster three hours after.	Nov. 24.

V.—AMPUTATION THROUGH THE METATARSAL AND METACARPAL BONES.

(*Amputatio Metatarsi et Metacarpi*, Lat.; *Amputation der Mittelfuss- und Mittelhandknochen*, Germ.; *Amputation des Os du Métatarse et du Métacarpe*, Fr.)

2727. Amputation through the metatarsal bones is differently performed, according as the metatarsal bone of the great or little toe, or of those between them are to be removed; and according as the soft parts are more or less destroyed.

The tourniquet should be applied above the knee and intrusted to one assistant; another holds the foot, and a third draws the toes asunder. The patient is to be placed as in amputation through the leg.

2728. *Amputation through the metatarsal bone of the great toe* is performed in different ways, according as the condition of the soft parts admits the formation of an inner, upper, or under flap.

2729. *If the flap be formed from the sole*, the operator, when the left foot is operated on, grasps the great toe, and draws it inwards, whilst an assistant draws the next toe outwards; but if the right foot be operated on, the operator grasps the second toe and draws it outwards whilst an assistant draws the great toe inwards. The knife is now carried between the toes vertically, along the outside of the great metatarsal bone, to the part where it is to be sawn through. The knife is next placed on the inner side of the bone, at like height with the angle of the first cut, near the lower edge of the bone, and makes, as it is drawn out along the under surface of the metacarpal bone, to its junction with the toe, a cut which separates the soft parts. The two cuts are now united by a transverse one running over the dorsal surface of the metatarsal bone about two lines below the angles of the two wounds; and a second transverse cut on the sole connects the front angles of both side cuts. The two flaps thus bounded are separated from the bone as far as the upper angle of the side cut, turned back and held by an assistant, who at the same time draws back the skin on the dorsal surface of the foot as far as possible, whilst the operator pulling the toe well inwards, away from the others, carries a narrow knife upon the back of the foot into the angle of the outer cut between the two bones, guides its edge towards the great metatarsal bone, cuts through the tendon, which he fixes with the thumb of his left hand, and carries the knife at the edge of the retracted skin, over the dorsal surface of the foot inwards, to cut through everything remaining attached to the bone. The knife is then passed from the sole, between the two bones, and carried along the edge of the retracted flap upon the under surface of the bone inwards. All the soft parts having been thus divided, are held back by a cleft cloth, and a thin splint being passed between the two metatarsal bones and held by an assistant, the bone is sawn through with a bow saw at the edge of the retracted skin.

The bleeding is stanched either by tying the vessels or by cold water, and after the wound has been properly cleansed, the flap is laid up over the bone in such way that its front edge is brought in close to the edge of the skin on the dorsal surface of the foot, and here fixed by several straps of sticking plaster applied from the sole. The edges of the wound on the second metatarsal bone are also brought together with sticking plaster.

Cutting through the tendon is often very troublesome; it is best done by thrusting the point of the knife between it and the bone, with the edge toward the tendon, up to the broad part of the blade.

2730. When the condition of the soft parts requires *the flap to be made on the inner side of the metatarsal bone of the great toe*, the skin there must be drawn inwards with the thumb and forefinger of the left hand, a straight knife thrust in vertically on the outer edge of the bone, about a finger's breadth from its tarsal junction, its point carried on the inside of the bone to the sole, and pushed through. The knife is then carried close along the bone, on its inner edge, to its junction with the great toe, and there cuts out obliquely. A cut lengthwise between the great and next metatarsal bone is now made in the same manner as in the former case, and continued to like height with the flap-cut; the flap is then held back, the knife placed in the upper angle of the longitudinal cut between the two bones, and carried over the back of the metatarsal bone to the angle of the flap-cut. The knife is next passed in below, between the bones, and carried round semicircularly, in the sole, to the lower angle of the flap-wound, and thus the division of all the soft parts still remaining attached to the bone completed. The cleft cloth having been now applied, the bone is sawn through in the same way as directed in the former case, and after the bleeding has been stanched, the flap is laid down over the bone on the corresponding wound-surface of the second metatarsal bone, confined with plaster, and dressed as already mentioned.

Where the condition of the bone permits, it is best sawn through obliquely from within outwards, so that the cut surface may correspond with the inner edge of the foot, by which the projection of the stump of the bone is prevented. In doing this, the longitudinal cut between the two metatarsal bones should end half an inch below the beginning of the flap cut, and the upper and lower cuts through the skin, tendons, and *periosteum*, connecting the two longitudinal cuts, carried obliquely from the one to the other, and the bone sawn through in a corresponding direction (*a*).

2731. When it is requisite to make *the flap on the dorsal surface of the metatarsal bone of the great toe*, a cut is made lengthwise between the first and second metatarsal bones up to the part where the bone is to be sawn through; next a longitudinal cut along the inner edge of the great metatarsal bone, and both connected by a transverse cut behind the head of the bone. The flap thus bounded, is separated from the side cuts, drawn back by an assistant, and, as in the formation of the flap on the sole, every thing covering the bone is divided by two semicircular cuts, at the edge of the retracted flap. The sawing through the bone and the dressing are to be as already directed.

Amputation of the metatarsal bone of the little toe is precisely similar to that of the great toe.

[These amputations of the great toe are exceedingly neat and well-looking operations, and if the metatarsal bone be sawn obliquely as Chelius directs, but little deformity ensues. Unfortunately, however, it often happens, especially in working people, that the flexor muscles of the other toes are incapable of sustaining the longitudinal arch of the foot, the great support of which is lost by the removal of the ball of the great toe, and the absence of firm attachment for the great flexor tendon of that toe, in consequence of which the whole inner edge of the foot comes to the ground, and the weight of the body upon the flap. The irritation to which its scar is necessarily subject, often also causes it to ulcerate, and a very troublesome and inconvenient sore, which completely lames the patient, is produced. I have seen this occur two or three times; for although the patient had left the Surgeon's hands with a very good-looking and well-shaped foot, yet a few months after he has returned in the condition I have just described. The Surgeon should, therefore, always endeavour to save the great toe, if possible; and if its amputation be absolutely necessary, I think amputation through the whole *metatarsus*, or even above the ankle better, for a working man certainly, than amputation through the great metatarsal bone.

Amputation through the little metatarsal bone is not liable to these objections, at least not to the same extent, because the weight of the body is thrown more on the inner than on the outer side of the foot.—J. F. S.]

2732. *Amputation through the intermediate metatarsal bones* is thus performed. A longitudinal cut is made on each side of the diseased metatarsal bone, by carrying the knife close along it, to the place where it is to be sawn through, in such way, however, that, on the sole, the cuts run into each other, in a V like shape, and one of them, for instance, on the left foot that on the outer, and on the right that on the inner side, should be three or four lines shorter than its fellow. The skin upon the dorsal surface of the foot is next cut through obliquely, from the angle of one to that of the other longitudinal wound, about two lines before the place of sawing. The skin is now to be drawn back, and all the soft parts separated by passing the knife between the bones on the sole and on the dorsal surface of the foot, in the oblique direction of the skin cut. The cleft cloth is now applied, the wooden splint passed in, up to the top of the side cut, and the bone divided obliquely with a fine saw from side to side. When the bleeding has been stanched, the neighbouring bones are brought together, and the skin brought over the end of the bone, by straps of plaster applied from the top of the foot downwards. The edges of the

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(*a*) Zang, book iv. p. 184.

wound are to be kept together with several circular straps round the foot, and a simple covering (*a*).

2733. *Amputation through the metacarpal bones* is performed in exactly the same way as that through the metatarsal bones, already mentioned.

Of the above modes of proceeding it must be decided which shall be followed, for the removal of some or all the metacarpal bones, except that of the thumb.

For amputating through the metacarpal bone of the thumb, a flap must be made on the volar surface, the soft parts on the back of the hand, divided correspondently with the base of the flap; then those in the space between the bones divided, and the metacarpal bones sawn off.

[In amputating through the metacarpal bones, and specially if only the head of the bone be cut off, as commonly practised, when the whole finger is to be removed, as the other fingers fall readily together, and do not produce the deformity which amputating at the knuckle does, it is better to cut through the bone with nippers than with a saw. LISTON observes:—"In using the forceps, the flat side is applied towards the trunk, so that the surface which is left may be perfectly smooth. One great advantage gained by employing the forceps is, that the palm can be left entire, the hand is much less deformed, the palmar arch is in general not interfered with, and the hæmorrhage is accordingly more trifling." (p. 365.) I do not think the palmar arch is more safe with the nippers than with the saw, as the soft parts require equal separation in both.—J. F. S.]

VI.—AMPUTATION THROUGH THE FINGERS AND TOES.

(*Amputatio Digitorum Manûs et Pedis*, Lat.; *Amputation der Finger und Zehen*, Germ.; *Amputation des Doigts et des Orteils*, Fr.)

2734. *Amputation through the phalanges of the fingers* is only indicated when some particular advantage is to be gained by keeping the stump, as in amputating the fore part of the second *phalanx*; in all other cases, disjointing the *phalanx* is to be preferred. In the toes, amputation must be restricted to that of the first joint of the great toe; because, by preserving the ball of that toe, advantage is gained over disjointing it.

Amputation of the *phalanges*, by means of *sharp nippers*, performed in the earliest times; or *with the chisel*, recommended by HELIODORUS, PAULUS ÆGINETA, and ALBUCASIS, and subsequently by many other writers, both within and without the joint, is entirely discarded; and in general, the disjointing of the *phalanx* is preferred. LE DRAN, GUTHRIE, SAMUEL COOPER, LANGENBECK, AVERILL, RUST, MALGAIGNE, and JAEGER agree in preserving the *phalanx*, and as to the advantage of amputation, though they differ from each other in regard to its application to a single finger. RUST holds only with the amputation through the second *phalanx* of the fore- and ring-fingers, and forbids it on all the phalanges of the two middle-fingers. LANGENBECK practises it on the first and second *phalanx* of the fore- and ring finger, and on the first of the thumb and little finger. AVERILL, on the other hand, employs it only for the thumb and fore-finger. JAEGER thinks it may be performed at the second *phalanx* of the fourth finger, with much advantage to the patient, especially the further forward it is done; and knows from experience that with the *phalanges* of the three outer fingers which can be drawn into the palm, better resistance can be produced.

LANGENBECK, ZANG, RUST, and JAEGER, are all in favour of amputation through the first *phalanx* of the great toe.

2735. In amputation through the *phalanges*, the skin having been properly drawn back, a circular cut is made with a scalpel, the skin again drawn back, the tendons and *periosteum* divided, sawn through, and the bone then sawn through. If the skin on the back of the finger be too much destroyed, or the *phalanx* too thick and broad, as that of the great toe, a flap may be made on the palmar surface, by thrusting the knife through there, and dividing the soft parts on the back with a semicircular cut, which is better than a dorsal flap, or than a flap before and behind, or on the side. (LANGENBECK, ZANG.)

(*a*) ZANG, above cited, p. 187.

In *cutting the finger off with a chisel*, (*Dactylosmileusis*, Lat.,) the finger must be laid on its dorsal surface on a little wooden block, and held by an assistant, who at the same time draws the skin back; a sharp chisel, as wide again as the finger, is to be placed vertically on the palmar surface, and held with the left hand, and the finger is struck off with a smart blow from a wooden mallet. In this way, which is generally objected to as rough and barbarous, and only recommended by GRAEFE and JAEGER, there is not any splintering; the operation is quick and little painful, and the cure is not more tedious than in the operation with the circular cut (*a*).

MAYOR (*b*) has recommended the removal of the *phalanx* by a peculiar instrument, the *tachytome*, with which, at the same time, sufficient flaps of the soft parts are formed.

FOURTH SECTION.—OF EXARTICULATION, OR AMPUTATION THROUGH THE JOINTS.

(*Exarticulatio Membrorum*, Lat.; *Ablösung der Glieder*, Germ.; *Désarticulation*, Fr.)

BRASDOR, Essai sur les Amputations dans les Articles; in Mémoires de l'Académie de Chirurgie, vol. v. p. 747.

WALTHER, Ueber die Amputationen in den Gelenken; in Abhandlungen aus dem Gebiete der praktischen Medicin, besonders der Chirurgie und Augenheilkunde, p. 91. Landshut.

MÜNZENTHALER, Versuch über die Amputationen in den Gelenken. Leipzig, 1822.

LISFRANC, Mémoire sur les règles générales des Désarticulations; in Revue Médicale, 1827, vol. i. p. 373.

SCOUTETTEN, La Méthode Ovalaire, ou nouvelle méthode pour amputer dans les Articulations. Paris, 1827. 4to.

ZANDERS, Die Ablösung der Glieder in Gelenk. Düsseldorff, 1831.

2736. *Amputations through joints* are in some cases the only means of preserving life, as in amputation at the shoulder- and hip-joints. In other cases amputation in the continuity of the bone cannot be performed, on account of its shortness, as in some *phalanges* of the fingers and toes. And, finally, there may be a choice between exarticulation and amputation in the continuity of the limb, in which case the exarticulation must be preferred, if the patient will be benefited by preserving a greater length of stump, as in exarticulations of the instep, in the knee- and wrist-joints. The danger of exarticulation, formerly held so great, is contradicted by the experience of modern times; and is by some, as LARREY, thought to be even less than in amputations in the continuity of limbs.

2737. The proceeding in exarticulation is very different. In general one or two flaps are formed, the size and direction of which depends partly on the nature of the joint, and partly on the injury which renders amputation necessary. SCOUTETTEN has proposed a particular method (*Méthode ovalaire*) for all joints, the peculiarity of which consists in an oval wound being formed, the extremity of which is near the joint, by two cuts being carried into one triangle. If the soft parts on the upper region of the joint be destroyed, they may be included by this method; the edges of the wound do not retract unequally, as they often do in the formation of flaps, and the wound unites by a linear scar. In many joints, however, exarticulation, according to this method, is more difficult than that with flaps.

LANGENBECK and others had long previously operated in this same way in the removal of several joints.

(*a*) SCHREIBER, Dissert. de Dactylosmileusi. Lips., 1815.—JAEGER, above cited, p. 250.
(*b*) Revue Suisse 1843.

2738. The processes of the bones most surely point out the place of the joint, which may even be discovered through the swollen parts. The knife should never be violently thrust into a joint, and in those joints, especially where their surfaces are locked into each other, not before their particular connexions have been cut through. In carrying the knife through the joint, its edge should always be directed towards the bone that is to be removed.

2739. It is frequently found in those cases where exarticulation is necessary, that the soft parts surrounding the joint are converted into a white, firm, lard-like substance. If this substance have not become soft, like pap, the flaps may be formed from it. By proper dressing this swelling may, however, be quickly lessened; and I have seen, in such cases, quick union take place just as well as in a perfectly healthy state of the soft parts (*a*).

I.—OF EXARTICULATION OF THE THIGH AT THE HIP.

(*Exarticulatio Femoris,* Lat.; *Ablösung des Schenkels aus dem Hüftgelenke,* Germ.; *Désarticulation de la Cuisse,* Fr.)

Morand, Sur l'Amputation de la Cuisse dans son Articulation avec l'Os de la Hanche; in his Opuscules de Chirurgie, p. 176. Paris, 1768.

Vohler; in same, p. 189.

Puthod; in same, p. 199.

Lalouette, An Femur in cavitate cotyloideâ aliquando amputandum? Paris, 1748; and in Halleri, Disputat. Chirurg., vol. v. p. 265.

Barbet; in Prix de l'Académie de Chirurgie, vol. iv. p. 1. Couronné en 1759.

Meckel und Unger, An Femur è cavitate cotyloideâ amputandum? Halæ, 1793.

Moublet; in Journal de Médecine, vol. xi. p. 240.

Tallichet, De resecto Femore exarticulo. Halæ, 1806.

Larrey; in Mémoires de Chirurgie Militaire, vol. ii. p. 180; vol. iii. p. 349; vol. iv. pp. 27, 50.

Thompson, John, M.D., Report of Observations made in the British Military Hospitals in Belgium after the Battle of Waterloo, with some remarks on Amputation. Edinburgh, 1816. 8vo.

Guthrie, G. J., On Gunshot Wounds of the Extremities requiring the different Operations of Amputation, with their After-treatment. London, 1815. 8vo. The same translated into German, with remarks by Spangenberg. Berlin, 1821.

Hedenus, A. G., Commentatio Chirurgica, de Femore in cavitate cotyloideâ amputando. Lips., 1823. 4to.; with plates.

Metz, H., Ueber die Lösung des Oberschenkels aus dem Huftgelenke. Inaug. Abhandl. Würzburg, 1841.

2740. *Exarticulation of the Thigh at the Hip-Joint,* is, of all amputations, the most dangerous; and the danger of the operation itself is considerably increased by the disease rendering it necessary. Of the cases hitherto published, in which this operation has been performed, the proportion of successful and unsuccessful results is about as 1 to $2\frac{1}{2}$ (*b*).

(*a*) Margot (Lisfranc), Sur les Amputations pratiques dans des Tissus lardacées, revenus à l'état normal à la suite de l'Opération; in Revue Médicale. 1827; vol. i. p. 41.

(*b*) Perault; in Sabatier, Médecine Opératoire.—Larrey, Mémoires, vol. iv. p. 27.—Brownrigg and Guthrie; in Samuel Cooper's Dictionary of Surgery, p. 84. Edition of 1838.—Delpech; in Revue Médicale. 1824; vol. iii. p. 333. 1828.—Wendelstadt; in Hufeland's Journal, vol. vi. p. 110. 1811.—Mott, V.; in London Medical and Physical Journal, vol. iii. p. 228. 1827.—Wagner, Ueber die Exarticulation des Obschenkels aus dem Huftgelenke; in Rust's Magazin, vol. xv. p. 261.—Orton, J., A Case of Amputation of the Hip-Joint successfully performed; in Med.-Chir. Trans., vol. xiii. p. 605.—Bryce, C.; in Glasgow Medical Journal. 1831; p. 262.—Macfallane, J., Clinical Reports of the Surgical Practice of the Glasgow Royal Infirmary, p. 182. Glasgow, 1832. In a child of two years old, on account of a compound fracture.—Cox, W. S., Memoir on Amputation of the Thigh at the Hip-Joint. London, 1845; fol.

Many die so long after, and in such way, that death cannot be directly ascribed to the operation.

Jaeger (*a*), who has performed this operation successfully, has collected all the cases known to him, of which the following, which were successful, must be mentioned, to wit, those of Baudens (*b*), Mayo (*c*), Sedillot (*d*), and Textor (*e*).

Krimer (*f*), who lost a patient from sudden spasm, ten days after operating, according to Larrey's method, considers this operation inadmissible on account of its danger. The results up to the present time do not confirm this objection. There is also little advantage in Krimer's proposal of, instead of the exarticulation, tying the common iliac artery so as to cause death of the diseased extremity ! ?

If the Surgeon hesitate to perform the operation through the joint, he could have no objection to perform it high up through the great *trochanter*, by which opening the joint would be avoided.—J. F. S.]

2741. So great extension of mortification as effects the thigh throughout its whole thickness, and such crushing of the thigh-bone, and of the soft parts as render flap-amputation below the great *trochanter* impossible, can alone be considered as indications for amputation at the hip-joint. *Caries* in the hip-joint can never indicate this operation because the socket is always affected.

[The first amputation through the hip-joint appears to have been performed by La Croix d'Orléans in 1748, on a boy of fourteen, both of whose lower limbs had become gangrenous from eating diseased rye; the first operation was through the right thigh, and four days after the left thigh was amputated at the hip-joint; he seemed to be going on very well, but died on the eleventh day after the second operation (*g*).

Perrault, of St. Maure, in Touraine, first operated with success in 1773 on a man who had gangrene of the thigh nearly up to the *pelvis*, in consequence of his thigh having been crushed between the pole of a carriage and the wall (*h*).

The first reported case in England, but which was unsuccessful, is that operated on by Kerr (*j*) of Northampton, in December 1774, (as appears from a letter from Harden of Northampton, to the late Sir William Blizard, for which I have to thank my friend Curling.) The patient was a girl between eleven and twelve years of age, with an abscess in the right hip-joint and hectic fever; after the operation Kerr "found not only the *acetabulum* carious, but also the adjacent parts of the *ossa innominata* to a very considerable extent." She went on very well till "the tenth or eleventh day, but then her respiration became more difficult, expectoration ceased, her mouth and tongue were covered with *aphthæ*, and she died on the eighteenth day from the operation." (p. 341.) This operation was performed with a single flap.

John Thomson (*k*) states, he has "been informed it (amputation at the hip-joint) was performed in London by the late Mr. H. Thomson, Surgeon to the London Hospital," and imagines "it must have been his operation to which Mr. Pott alludes." (p. 264.) The passage referred to in Pott (*l*) is the following:—"I cannot say that I have ever done it, but I have seen it done, and am now very sure I shall never do it unless it be on a dead body." (p. 394, in note reviewing the opinions of Bilguer and Tissot on amputation at the hip-joint.) Not being able to find any published account of this case, I have inquired of Curling whether there be any record of it at the London Hospital, and he informs me that there is not any. Probably it did not succeed, as no notice is left of it; and whether Thomson or Perrault operated first, or whether Thomson operated before Kerr I cannot ascertain.—J. F. S.]

2742. The modes of proceeding in exarticulations at the hip-joint have been, since the time of Vohler, who broached the idea of this operation, variously laid down; many of these, however, rest only on experiments on the dead body, and depend generally on the condition of the soft parts,

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(*a*) Hamburger Zeitschrift, vol. iii. part i.

(*b*) In same.

(*c*) Lancet. 1836-7; vol. i. p. 110.

(*d*) Archives générales de Médecine, vol. ix. p. 225. 1840.

(*e*) Metz, above cited.

(*f*) von Graefe und von Walther's Journal, vol. xii. p. 121.

(*g*) Barbet, above cited, p. 9.

(*h*) Sabatier, Médecine Opératoire, vol. iv. p. 542.

(*j*) An Account of the Operation of Amputating the Thigh at the Upper Articulation, lately performed; in Medical and Philosophical Commentaries, by a Society in Edinburgh, vol. vi. 1779.

(*k*) Report of Observations made in the British Military Hospitals in Belgium, after the Battle of Waterloo, with some Remarks on Amputation. Edinburgh, 1816. 8vo.

(*l*) Chirurgical Works, vol. iii. Edition of 1783.

and the nature of the injury. The several modes of operation may be disposed under the following heads—*a.* the circular cut; *b.* the flap cut, with one or two flaps; *c.* the oval cut.

a. The Circular Cut.

2743. Here belong the modes of ABERNETHY, VEITCH, KERR, and GRAEFE.

2744. According to ABERNETHY (*a*), the Surgeon standing on the outer side of the limb, the femoral artery being compressed by the fingers upon the pubic bone, makes, an inch below the joint, two successive circular cuts, by which he divides the muscles from the great and little *trochanter*, cuts into the capsule, dislocates the head and divides the round ligament.

2745. VEITCH (*b*) proposed making the amputation of the thigh below the joint in the common way with the circular cut, and sawing through the bone two inches below the cut. After the arteries have been tied, the patient is to be placed on his side and a vertical cut made from the great *trochanter* to the wound, the muscles to be separated on the outside of the thigh, the joint opened and the bone disjointed.

COLE's (*c*) method, who amputated through the *trochanter major* and removed the neck and head, corresponds with this. JAEGER proceeded in the same way in his successful case, in which, whilst amputating through the upper third of the thigh with an external flap, he noticed the *caries* extending higher between the *lamellæ*, again sawed off the bone two or three inches higher, and even then finding the disease extending up to the *trochanter*, he merely extended the upper angle of the flap on the fore and outer side two inches upwards, cut into the capsule without any great difficulty, then through the round ligament and easily removed the bone. The stump had everywhere flesh to spare which was however no evil, and after the cure it was six inches long, felt hard as if the bone were still remaining in it, and could in some degree be drawn inwards.

2746. KERR (*d*) having first bent the thigh at a right angle with the trunk, made a cut through the skin, from behind the top of the *trochanter* obliquely backwards and downwards to the inside of the thigh, and from thence obliquely upwards to within two inches from the femoral artery; then a second beginning at the same place as the former, but carried in an opposite direction over the upper extremity of the *trochanter*, and from thence obliquely forwards and downwards to within the same distance of the vessel as in the former cut. He then cut through the muscles in the direction of the skin cuts, and separated the bone from the joint; grasped firmly the flap still undivided, and containing the artery, betwixt the fingers and thumb of his left hand, his fingers on the skin side of it, and his thumb on the muscular side, cut it through about four inches below the inguinal ligament, and tied the artery.

[KERR states further that the compression was so complete "as to prevent the loss of a single drop of blood, and the hæmorrhage from the other arteries was full as inconsiderable as in any other amputation of the thigh. * * * The ligature fell off at the fourth or fifth dressing." (p. 341.) In HARDEN's letter it is further stated, that "two other small arteries only were taken up, and the blood lost during the operation was very trifling. The large artery was tied immediately above a branch going off which I think is called the *profunda.* Perhaps the operation could not be done with so much ease where the ligaments of the joint had not been previously destroyed, as was the case here."]

2747. According to GRAEFE's (*e*) experiments on the dead body, the femoral artery should be compressed with a roller, and PIPELLET's or

(*a*) Lectures, on authority of S. COOPER.

(*b*) Edinburgh Medical and Surgical Journal, vol. iii. p. 129. 1807.

(*c*) SAMUEL COOPER's Surgical Dictionary, p. 83.

(*d*) Above cited, p. 339.

(*e*) Normen zur Ablösung grösserer Gliedmassen, p. 117.

MOORE's compressor; the skin is then to be divided with a circular cut, three or four fingers' breadth below the *trochanter*, and after having been moderately drawn back by an assistant, his leaf-knife (*Blattmesser*) is to be placed as deeply as possible on the outer side close to the edge of the retracted skin, the leaf sunk obliquely to the *trochanter*, drawn over the front to the inner side, so that its edge runs along the neck close to the thigh-bone, and the cut completed in the usual way. If large vessels bleed which cannot be compressed by the assistant, they must be tied if not too close to the middle of the wound. The muscles are now drawn up by an assistant, and the fleshy parts first divided on the outside to the very point of the *trochanter*, with the blade of the leaf-knife kept directly upwards. An assistant now turns the knee outwards, the muscles are divided on the inner side with the blade of the leaf knife directed upwards till the edge of the hip-socket appears. The transverse ligament is then divided with the edge of the knife held rather obliquely, and whilst the assistant rolls the head of the bone inwards and upwards, placing one hand below the *trochanter*, and the other on the inside of the knee, the operator pressing the knife firmly cuts through the capsular ligament on the inside. The assistant now carries the thigh far outwards till it forms a right angle with the side of the body, and the operator with one smart stroke cuts through the outer under part of the capsular ligament and the muscles still attached in this region, by which the head of the bone is completely freed. After stanching the blood, the wound is to be brought together obliquely with two sutures and strips of sticking plaster.

b. The Flap Cut.

* With a single flap.

2748. The operation of exarticulation *with one flap* is variously performed, according as it is a *hinder* (PUTHOD, BRYCE); an *inner* (L'ALOUETTE, DELPECH, LENOIR, LANGENBECK); a *front* (PLANTADE, MANEC) or an *outer* flap.

2749. According to PUTHOD, the femoral artery having been first tied, the patient laid on his side and properly held, and the skin drawn upwards by an assistant, a transverse semicircular cut is to be made through the skin, beginning on the inner hinder part of the thigh, and ending at the great *trochanter*. After drawing the skin back the tendon of the *m. glutæus maximus* is cut through, and by carrying the knife along the *trochanter* all the muscles there inserted are divided. The knife is now to be thrust into the joint below the tendon of the *m. gracilis*, and the capsular ligament cut across; after which the thigh is drawn upwards and inwards so that the head of the bone may project outwards and upwards, and then the stretched round ligament is cut through and the division of the capsular ligament completed. The muscles of the hinder inner side of the thigh are now divided, four or five fingers' breadth from their insertion, and then the muscles on the inside at the top of the little *trochanter* cut through (*a*).

HUNCZORSKY (*b*) directs the following mode of proceeding. After tying the femoral artery, the patient being laid upon his belly, and the thigh drawn somewhat inwards to render the *m. glutæi* tense, the skin is drawn back, and cut through three fingers' breadth below the *trochanter major*, and after it has been turned back, the *m. glutæi* are cut off at the *trochanter;* the knife is then carried outwards to make one flap of flesh which is raised up, and the cut being continued quite down to the joint, and the head

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(*a*) MORAND, above cited.

(*b*) Anweisung zu Chirurg. Operationen, p. 256.

twisted on itself, the other part of the capsular ligament and the round ligament are divided, and the operation completed by cutting through the muscles on the other side of the thigh.

2750. BRYCE (*a*) compresses the femoral artery, and makes a transverse cut on its inner side above the *trochanter*, above the highest part of the hip, ties the femoral artery, cuts through the capsular ligament, separates the head of the bone, and at last forms the lower flap.

2751. According to L'ALOUETTE, the patient should be placed on his sound side, the femoral artery compressed with a tourniquet, the thigh stretched out, and an assistant draws the skin back. With a semicircular cut extending from the upper outer part of the great *trochanter* to the ischial tuberosity, all the soft parts are cut through to the joint. The joint is now felt for with the nail of the left forefinger, and the capsular ligament opened. The assistant rolls the thigh inwards, the projecting round ligament is divided with a button-ended bistoury, and the head of the bone dislocated by bending the thigh towards the chest, upon which the knife being carried round the capsular ligament, completely divides it, and a flap is formed four or five fingers broad, by bringing the knife down on the inside of the bone.

2752. According to LANGENBECK (*b*), a transverse cut should be made from the front of the thigh, not too near the femoral artery, on the outer side, down to the back part of the thigh, opposite the ischial tuberosity, which should divide the soft parts to the neck of the bone; then by turning the knee inwards the exarticulation of the head is effected, and the inner flap is formed by cutting round the inner surface of the thigh.

2753. DELPECH (*c*), who has performed this operation twice successfully, after having tied the femoral artery, thrusts a single-edged knife two inches below the superior anterior spine of the *ilium*, between the *m. sartorius* and *m. tensor vaginæ femoris*, to the neck of the thigh-bone, inclines the point inwards, and pushing it well into the cavity between the little *trochanter* and the neck, thrusts it through at the hinder part. The knife is now drawn down on the inside of the thigh-bone, and by cutting inwards a flap is formed about eight inches long. This flap is held back by an assistant, and any spouting vessel in it tied. The thigh is now inclined outwards, the capsular ligament divided semicircularly, the head of the bone dislocated, the round ligament cut through, the knife carried behind the head, and the mass of muscle and skin divided by a horizontal cut. After the vessels are tied, the flap is brought over the wound and united with sutures an inch apart. Too much skin should not be preserved on the outer side, and it is better, if necessary, to make the inner flap longer. This method is a modification of LARREY'S, in which an outer flap is also formed.

In this way, ORTON, CLOT, CHERUBINI, and WELL have operated, excepting that CLOT did not tie the femoral artery first.

2754. LENOIR (*d*) compresses the femoral artery, and standing on the outer side of the limb, which is inclined inwards, makes a transverse cut on the hinder outer side, draws the soft parts back, penetrates into the outer hinder part of the joint, and ends by forming an internal flap. An assistant compresses the artery in the flap till it is tied.

2755. According to PLANTADE (*e*), an *upper* or *front* flap should be

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(*a*) Above cited.

(*b*) Bibliothek für die Chirurgie, vol. iv. p. 512.

(*c*) Journal général de Médecine, vol. ciii. p. 429. 1828.

(*d*) Journal Hebdomadaire, vol. v. p. 205. 1831.

(*e*) VELPEAU, Médecine Opératoire, vol. i. p. 250.

formed by two vertical cuts on the sides, connected by a transverse cut, as in La Faye's mode of exarticulation at the shoulder.

2756. According to Manec (*a*), whilst the extremity is drawn outwards and a little bent, a double-edged knife is thrust between the great *trochanter* and front iliac spine from above downwards, and from without inwards, between the neck of the thigh-bone and the muscles, and as the knife is carried close down on the bone, a sufficiently long flap is cut, which an assistant raises, and compresses the artery found in it. The operator now passes the knife below the joint, places it on the inner angle of the wound, and divides to the outer angle all the soft parts to the bone. The capsule of the joint is then opened by a smart cut on its front, the head of the bone projected by abducting the thigh, the round ligament divided, and the rest of the capsule completely divided. After the formation of the flap, the joint may be entered in front, and the hind parts separated by a cut from within outwards.

2757. If the condition of the soft parts only permit an outer flap, when the femoral artery has been either first tied or properly compressed, the knife must be thrust vertically, below the middle of Poupart's ligament, and the whole mass of soft parts cut through directly inwards. The thigh is now to be carried well outwards, the capsular ligament opened, the round ligament divided, the head of the bone pressed out of its socket, and by passing the knife round and drawing it down, the flap is formed. I have performed the operation in this way upon a living person.

* * With two flaps.

2758. This mode of proceeding *with two flaps*, varies according as it is performed with an *inner and outer* (A. Blandin, Larrey, Dupuytren, Lisfranc, von Walther), or *with a fore and hind flap* (Wohler, Bell, Beclard, Begin, and Sanson), and according to the formation of one or other flap, and also whether by thrusting in the knife, or by carrying it from without inwards.

2759. A. Blandin ties the femoral artery first, and whilst he thrusts the knife into the lower angle of the wound, made for tying the artery, through the whole thickness of the thigh, he forms an inner flap, afterwards the outer one, and then proceeds to the division of the capsule and the exarticulation.

2760. According to Larrey, the femoral artery and vein should first be tied close to Poupart's ligament; then a straight sufficiently long knife thrust in on the front of the thigh and carried between the flexor muscles attached to the little *trochanter*, and base of the neck of the bone backwards, so that it may come out directly opposite the point of entrance. The edge of the knife is now turned obliquely inwards, and with a stroke all the muscles on the upper and inner part of the thigh cut through, and an inner, not very large, flap formed, which must be held back, and the bleeding vessels tied. The thigh is now to be abducted, so that the ligaments may be stretched, the inside of the capsular ligament divided with a bistoury, then the round ligament, and whilst the abduction is increased, the head of the bone dislocated. The edge of the large amputating knife placed behind the head of the bone, is now carried close behind the great *trochanter*, and the outer flap formed by cutting the muscles and skin obliquely. The spouting vessels are compressed by

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(*a*) Velpeau, Médecine Opératoire. 1839. Second Edition; vol. ii. p. 546.

an assistant, and carefully tied, and after the surface of the wound has been properly cleansed, the flaps are brought into apposition, some sutures applied, the union supported by strips of sticking plaster, covered with lint, and a compress, and fixed with a proper bandage.

Larrey (*a*) has subsequently recommended another method, in which after tying the crural artery, he makes a circular cut immediately below the great *trochanter*, through the skin, to determine the length of the flap. The inner flap must then be made either from without inwards, or from within outwards, according to the condition of the parts. The capsular ligament is divided with the same knife, the head of the bone dislocated inwards, the round ligament divided, and the knife being carried over it into the skin-cut, the outer flap is thus formed. After tying the bleeding vessels, the ligatures are placed in the bottom of the wound, and a piece of oiled linen put into that angle of the wound nearest to the hip-socket, and then the flaps closed.

Mott (*b*) forms the inner flap according to Larrey's method, by thrusting in the knife, and the outer flap by cutting from without inwards.

2761. According to Dupuytren (*c*), the operator, placed on the inner side of the thigh, and the artery being properly compressed, makes a semicircular cut from the region of the upper front spine of the *ilium*, over the inner side to the ischial tuberosity, through the skin, draws it backwards, cuts through the muscles in the same direction, thus forming an inner flap four or five inches long, turns this back, divides the capsule, and finishes the operation by the formation of the outer flap.

According to Dupuytren's (*d*) earlier experience, the operator should stand on the outer side of the limb, with his hands on the upper part of the thigh, so that by gently moving he can discover the situation of the joint. From this place he makes a semicircular cut passing three inches down, over the outer hinder part, and ending half an inch below the ischial tuberosity; the skin is then drawn back and the muscles divided at its edge down to the bone. To this outer cut, the operator makes a second and corresponding one over the inner side of the thigh, which joins the first at the points where it begins and ends. The outer and inner flaps are separated up to the joint, and held back by an assistant. The capsule is divided by a circular cut, afterwards the round ligament, and then the head of the bone is removed.

2762. According to Lisfranc (*e*) the thigh is to be held extended by an assistant, and the operator, standing on the outside of the limb, draws a line from the front upper spine of the *ilium*, parallel with the axis of the thigh, and an inch in length, from the lower inner end of which, at a right angle to it or transversely a second line half an inch long. At the end of this latter line he thrusts the point of a long straight knife, with its edge following a line from its entrance to the upper outer part of the great *trochanter*. The blade of the knife now upon the outer side of the head of the thigh-bone, passes round it and projects at the middle hinder part of the buttock. By some strokes upwards and outwards, avoiding the great *trochanter*, the knife is carried along the thigh two inches, and thus the flap is completed. After the bleeding arteries have been tied, an assistant holds the flap back. The knife is now carried round the neck of the bone, and again passed to the hind upper angle of the wound, the soft parts, if necessary, being pressed inwards, to avoid the lesser *trochanter*, and a flap formed on the inner side of the bone, of the same length and form as the outer. The operator then grasps the thigh with his left hand, brings the edge of the knife perpendicularly upon the inner side of the head of the bone, which he runs round as much as possible, divides the

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(*a*) Clinique Chirurgicale, vol. iii. p. 611.

(*b*) Above cited.

(*c*) Leçons Orales, vol. iii. p. 363.

(*d*) Archives générales de Médecine. 1823; vol. i. p. 171.

(*e*) Archives générales de Médecine. 1823; vol. i. p. 177.—Münzenthaler, above cited, p. 38.—Averill, above cited, p. 158.—Syme; in Edinburgh Medical and Surgical Journal, vol. xix. p. 657. 1823.—Maingault, above cited, pl. viii. fig. 29.

capsular and round ligaments, and then cuts from within outwards the rest of the capsule and whatever muscular fibres still remain attached.

2763. von Walther (*a*) compresses the femoral artery with a compressor against the pubic bone; thrusts a double-edged amputation knife, three inches below the upper front spine of the *ilium*, at the outer edge of the *m. sartorius*, vertically down upon the neck of the thigh-bone, carries it outwards and backwards around it, and pushes it out two inches and a half behind the great *trochanter*, at a corresponding height to its point of entrance; the knife now kept close to the bone, cuts two inches below the base of the *trochanter* obliquely outwards, and forms an oblong *outer* flap, which being drawn back, the exposed capsular ligament is cut into, the head of the bone dislocated outwards and downwards, and the round ligament divided. With a single-edged amputating knife he now passes through the cavity of the joint, behind the head of the thigh-bone and round the little *trochanter*, and continues two inches down along the inside of the thigh close to the bone. The femoral artery and neighbouring vessels are now to be compressed, as high up as possible, by both the thumbs of an assistant placed upon the surface of the wound, and then the edge of the knife being inclined obliquely inwards, the operation is completed by forming the *inner* flap.

2764. According to Vohler, the femoral vessels should be laid bare by a cut on Poupart's ligament and tied, and then the patient having been placed on his belly, the skin and *m. glutæus maximus* are to be cut through two fingers' breadth below the ischial tuberosity, and the flap so formed drawn up; the muscles attached to the *trochanter* are then cut through to the capsular ligament, which is opened whilst the thigh is slightly moved, and cut through forwards together with the muscles on the outer and fore part of the thigh. The vessels must be in part compressed, and in part tied. The hinder flap covers the wound.

2765. According to Bell (*b*), the femoral artery should be compressed by a tourniquet against the pubic bone, and the thigh being bent on the groin, the skin and flesh of the thigh are to be divided with two circular cuts six inches below the joint, and every important vessel on the surface of the wound tied. Two longitudinal cuts are now made upwards from the circular, one behind from the head of the thigh-bone, and another before, so that two flaps are formed, one on the outer and the other on the inner side of the thigh. These are separated to expose the joint, the head of the bone dislocated, and if broken, it must be pulled out with the forceps.

2766. According to Beclard (*c*), the thigh should be slightly bent so as to relax the parts on its fore part, then in the middle of the space between the upper front spine of the *ilium* and the great *trochanter*, the knife is thrust in horizontally, carried close over the neck and head of the thigh-bone, and the handle being raised a little, thrust through opposite its point of entrance. By drawing the knife down a flap is made, six fingers' breadth long, which an assistant raises, and at the same time compresses the femoral artery. The front of the joint is now laid bare, the capsular ligament cut into, and afterwards the round ligament, the head of the bone dislocated by moving the thigh backwards, and the whole knife being carried behind the head, divides the back of the capsule, and forms the hinder flap of equal length with that in front.

(*a*) Graefe und Walther's Journal, vol. vi. p. 11. 1824.

(*b*) Above cited, vol. iv.

(*c*) Dictionnaire de Medecine et de Chirurgie pratiques, Article *Amputation*, vol. ii. p. 278. 1829.

[Liston's (*a*) operation is the same as Beclard's, and he observes:—"This mode of getting at the head and neck of the bone is much preferable to that usually followed, and is in every respect safer, as he has more than once ascertained from actual practice on the living body. The fore part of the articulation is fully exposed immediately on the anterior flap being formed. The capsular ligament is cut by drawing the knife across determinedly, as if it were the intention of the operator to cut off the head of the bone. The round ligament and the posterior portion of the capsule are cut, and the blade of the instrument having been passed behind the neck and *trochanters*, the posterior flap is quickly formed so as to allow the limb to drop. The vessels on the posterior aspect are tied fast; then the femoral and those in the anterior flap, which had been commanded by the assistant, are uncovered one by one, and secured." (p. 387.)]

2767. Begin and Sanson (*b*) first make a semicircular cut, with its concavity upwards, through the skin and cellular tissue, beginning from the point of the great *trochanter*, carried over the front of the thigh and ending at the tuberosity. The skin is drawn back and the femoral artery tied. The front flap is then made, either from without inwards, or from within outwards, by a thrust, and afterwards the hind flap, the one angle of which must correspond with the great *trochanter* and the other with the tuberosity. The operation is finished by the exarticulation of the head.

* * * The Oval Cut.

2768. According to Sanson, the operator, standing on the outside of the limb, makes a cut obliquely from below upwards and from within outwards, beginning it four fingers' breadth below the *perinæum*, carrying it over the front of the joint, and ending it at the point of the great *trochanter*. This cut divides the skin and superficial muscles, and the femoral artery is now tied. A second cut beginning from the inner angle of the first, is carried over the hind part of the limb and united with the former at the point of the *trochanter;* it divides the skin and the mass of muscles as deep as possible. The knife is now passed into the first cut, its edge directed towards the hip-socket, the thigh dropped, by which the head is protruded, and then the capsular and round ligaments are divided. The knife is now carried round the head from within outwards, then backwards and afterwards inwards, care being taken that it do not for an instant leave the socket. This operation is very quick.

2769. Guthrie (*c*) gives the following mode of performing this operation. An assistant standing on the opposite side, and leaning over, should compress the artery against the brim of the *pelvis*, with a firm hard compress of linen, such as is generally used before the tourniquet; he should also be able to do it with his thumb, behind the compress, if it be found insufficient. The Surgeon standing on the inside, with a strong, pointed amputating knife of a middle size, makes his first incision through the skin membrane, and *fascia*, so as to mark out the flaps on cellular each side, commencing about four fingers' breadth, and in a direct line below the anterior superior spinous process of the *ilium* in a well-sized man; and continuing it round in a slanting direction at an almost equal distance from the tuberosity of the *ischium*, nearly opposite to the place where the incision commenced. Bringing the knife to the outside of the thigh, he connects the point of the incision where he left off with the place of commencement, by a gently-curved line, by which means the outer incision is not in extent more than one-third of the size of the in-

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(*a*) Practical Surgery.

(*b*) Sabatier, Médecine Opératoire, par Sanson et Begin, vol. iv. p. 682.

(*c*) Above cited, pp. 363, 364.

ternal one. The integuments having retracted, the *m. glutæus maximus* is to be cut from its insertion in the *linea aspera* and the tendons of the *m. glutæus medius* and *minimus* from the top of the *trochanter major*. The Surgeon now placing the edge of the knife on the line of the retracted muscles of the first incision, cuts steadily through the whole of the others, blood vessels, &c., on the inside of the thigh. The artery and vein, or two arteries and a vein of the *profunda* is given off high up, are to be taken between the fingers and thumb of the left hand, until the Surgeon can draw each vessel out with the tenaculum, and place a ligature upon it. Whilst this is doing the assistants should press with their fingers on any small vessels that bleed. The Surgeon then cuts through the small muscles running to be inserted between the *trochanters* and those on the upper part of the thigh, not yet divided; and with a large scalpel opens into the capsular ligament, the bone being strongly moved outwards, by which its round head puts the ligament on the stretch. Having extensively divided it on the fore part and inside, the *ligamentum teres* may now be readily cut through. The head of the bone is then easily dislocated, and two or three strokes of the knife separate any attachment the thigh may still have to the *pelvis*. The vessels are now carefully to be secured. The capsular ligament, and as much of the ligamentous edge of the *acetabulum* ought to be removed as can be readily taken away. The nerves, if long, are to be cut short, the wound well sponged with cold water, and the integuments brought together in a line from the spinous process of the *ilium* to the tuberosity of the *ischium*. Three sutures will in general be required, in addition to the straps of adhesive plaster to keep the parts together.

2770. According to Scoutetten the patient is laid across the bed, and upon the opposite side to that on which the operation is to be performed; his head raised a little above the *pelvis*, which should project beyond the bed, and in this position he is to be held by assistants, and the artery compressed at the groin. In operating on the *left* thigh, the Surgeon, placing himself at the hinder part of the limb, assures himself with his left hand of the position of the great *trochanter*, and places his thumb or forefinger upon it. With his right hand he thrusts in the point of the knife, above the *trochanter*, vertically, sinks the blade a little and directs it forwards and inwards four fingers' breadth below the crease of the groin and carries round the joint, whilst pressing it as deeply as possible through the parts. This cut is now left, for the purpose of carrying the knife, its point directed inwards and downwards, on the inside of the thigh, into the lower angle of the first cut; the knife is then directed obliquely backwards to pass into the beginning of the first cut. It is very rare that in these cuts all the parts are at once divided down to the bone; most commonly it is necessary that the knife should be again entered into the wound to complete their division. To get at the capsule of the joint, the edges of the wound must be further separated and the undivided muscles cut through; and when the capsule is exposed, it must be cut into by placing the knife perpendicularly upon it; the limb being then dropped and the point of the toe turned outwards, the head of the bone partly protrudes from the socket, and where held by the round ligament, that must be divided with the point of the knife. The operator then lifts up the thigh in order to throw the head out, and running the knife round it divides the hind third of the capsule and the muscular fibres still remaining attached, and separates the limb. In operating on the *right* thigh, the Surgeon places himself on the fore part of the limb, but the other proceedings are the same.

2771. Cornuau lays down the following mode of practice. The patient being laid on his sound side, the operator with the fingers of his left hand ascertains the situation of the great *trochanter*, from the top of which he makes his first cut obliquely downwards and forwards to a right angle, formed by the union of a horizontal line from the ischial tuberosity with another descending vertically from the upper front spine of the *ilium*. A second cut of equal length, and forming with the first an acute angle upon the great *trochanter*, passes obliquely backwards and downwards to the middle of the thickness of the limb. The outer, hinder and fore part of the joint is now laid bare; the capsular ligament must be opened as near as possible to the edge of the socket; after the division of the rest of the muscles which remain undivided by the first cut, the head is dislocated outwards, the round ligament easily separated, and the knife carried round the head towards the inner side of the limb. One assistant on the outside grasps the front flap of the wound, and in its thickness compresses the femoral artery; another draws the skin of the inside of the thigh upwards, whilst the operator with his left hand supporting the thigh, uses the knife till it come to the lower angle of the first cut, which finishes the division of the soft parts, rounds the inside of the wound, and completes the removal of the limb.

2772. Of these several modes of proceeding which have been proposed for the exarticulation of the thigh-bone, I hold Larrey's with the thrust of the knife, and the formation of an inner and an outer flap, (*par.* 2760,) or if the condition of the parts permit, the formation of a single inner flap, (*par.* 2753,) or of a single outer flap, (*par.* 2757,) the most preferable in regard to safety and ease of performance. It has also been, in most of the published cases, in which the operation has had a successful result, the way in which, with slight deviations, it has been performed. As to the objection in reference to the bleeding, the artery may be previously tied, if there be no competent assistant to be intrusted with its compression.

The wound should be brought together with sutures and strips of plaster, a piece of oiled linen put in the lower corner of the wound, and the whole covered with lint and compress fastened with the inguinal bandage. Jaeger holds this dressing not always of use, recommends cold fomentations and applies the dressing just after suppuration has come on.

II.—OF EXARTICULATION OF THE LEG AT THE KNEE.

(*Exarticulatio Cruris*, Lat.; *Ablösung des Unterschenkels im Kniegelenke*, Germ.; *Désarticulation de la Jambe*, Fr.)

Brasdor, above cited,

Textor, Ueber die Amputation im Kniegelenke; in neue Chiron, vol. i. p. 1.

Velpeau, Mémoire sur l'Amputation de la Jambe dans l'Articulation du Genou; in Archives Générales de Médecine, vol. xxiv. p. 44. 1830.

———, Discussion Nouvelle à l'occasion du Rapport de M. Larrey, sur l'importance et les avantages de l'Amputation de la Jambe dans l'article; in Journ. Univ. et Hebdom. de Méd. et Chir. Pratiques. Novembre, 1830.

2773. *Amputation of the leg at the knee-joint*, heretofore recommended by Guillemeau in 1612, and by Fabricius Hildanus, has been considered by most writers as improper, or inferior to amputation through the continuity of the thigh. Brasdor, J. L. Petit, and Hoin have recommended it; and Volpi, Kern, Textor, Langenbeck, Velpeau, and others have shown the applicability of this mode to those cases, where, in consequence of the extensive destruction of the front of the leg, amputation through it is not possible, though there may still remain soft parts for covering the condyles, if exarticulation be performed. Many Surgeons object to it unconditionally, as Zang, Larrey, Dupuytren, and others.

From Jaeger's (*a*) collection of the published cases of amputation at the knee-joint, it appears that of thirty-seven, about twenty-two have had a favourable, and fourteen an unfavourable result.

2774. Exarticulation at the knee-joint may be formed either with the flap or the circular cut. The patient is placed as in amputation through the thigh; and the femoral artery compressed by an assistant, or with a tourniquet.

2775. In the *amputation with the flap cut*, it is best to make the flap from the back of the leg in the following manner:—After the femoral artery has been properly compressed, and the leg being held straight out, the assistant who holds the thigh, draws the skin back. With a straight small amputating knife, a transverse, or a semilunar (Sabatier, Textor) cut is made through the skin, from one condyle to the other. The leg is now bent to tighten the ligament of the knee-cap, and the Surgeon grasping it with the left hand, cuts through with the same knife, first this ligament, then the lateral ligaments, and, lastly, the crucial ligaments. He then takes a larger amputating knife, carries it close to the hind surface of the shin- and splint-bones, some little distance down, and forms, in cutting obliquely downwards, a flap sufficient to cover the exposed joint-surfaces. After the vessels have been properly tied, the flap from behind is brought close into contact with the front edge of the skin, and the dressing applied, as after amputating the leg with a single flap.

The following modes of proceeding are less convenient:—*First*, According to Blandin (*b*), when the patient has been placed on his belly, and the femoral artery is compressed, a catlin is passed at the joint, above the bones from one side to the other through the soft parts, and carried down to form a flap about six inches long. An assistant holds back this flap, whilst a semicircular cut is made at its base, from one angle to the other, over the front of the joint below the knee-cap, through the teguments, the joint is then opened, and by the division of the lateral and crucial ligaments, and of the ligament of the knee-cap, the operation is completed. *Second*, The formation of two flaps. According to Rossi (*c*), a cut is to be made on both sides of the knee, which are connected with each other by an arch, and the two flaps thereby described, are dissected back and turned over: the ligament of the knee-cap is then divided, the knife carried into the joint and everything cut through. According to Maingault (*d*), a narrow straight knife is to be thrust through the joint, on the inside of the thigh, behind the knee-cap, but before and below the condyle, and by carrying it down the ligament of the knee-cap, the general coverings are cut through to the tubercle of the shin-bone. This flap is then raised, the lateral and crucial ligaments cut through and by drawing the knife down, the hinder flap is formed. According to Kern, the flap should be formed by two cuts from the outer sides of both condyles of the thigh-bone towards the spine of the shin-bone, of a V shape, and four or five inches long, and after dividing the ligaments, a hind flap of four inches is formed.

(*a*) Handwörterbuch der Chirurgie, vol. i. p. 369.

(*b*) Dictionnaire de Médecine. Article *Amputation*, vol. ii. p. 282.

(*c*) Elém. de Méd. Opérat., vol. ii. p. 227. Turin, 1806.

(*d*) Above cited.—Froriep's Chirurg. Kupf. Taf., pl. cvii. fig. 1, 2.

2776. In the *circular cut*, according to **Velpeau**, the leg being stretched out, a circular cut, three or four fingers' breadth below the knee-cap, divides the skin, which is then dissected up and turned back, and whilst the thigh is grasped with the left hand, and a little bent, the ligaments are divided from before backwards, and the muscles and vessels lying behind, are cut through at a stroke. After the vessels are tied, the wound is brought together vertically, or horizontally.

Velpeau has twice operated in this way successfully, and has given up the method which he formerly recommended. According to **Cornuau**, it is less advantageous to divide the soft parts by a circular cut at the edge of the skin, after it has been turned back, and then by dividing the lateral ligaments, to penetrate into the joint. Equally so is the *oval cut* after **Baudens**' method; he makes a mark with a pen from the spine of the shin-bone three fingers' breadth below the ligament of the knee-cap, which he carries obliquely backwards, and from below upwards, towards the knee-cap, and ends only two fingers' breadth below a line corresponding to the ligament of the knee-cap. An assistant draws the skin of the knee upwards, the operator makes a cut along the marked line of the oval, the skin is then drawn back on the joint, and this, together with the *aponeurosis* and tendons, cut through, and the lips of the wound united lengthwise.

If the knee-cap be diseased, the skin is to be separated from it, and itself from the tendon of the *m. rectus* and the capsular ligament, which is better than making a Λ shaped cut through the skin, as recommended by **Brasdor**.

Exarticulation of the Ankle-Joint, proposed by **Brasdor** and others, and entirely rejected by most Surgeons, but in modern times recommended by **Lisfranc**, **Malgaigne**, **Baudens**, and **Jaeger**, is in every respect inferior to amputation through the leg, as it is always more difficult and dangerous, and always forms a bad stump, and unfitting for the application of an artificial foot.

[II.*—OF EXARTICULATION OF THE FOOT AT THE ANKLE.

(*Exarticulatio Pedis*, Lat.; *Ablösung des Fusses im Fussgelenke*, Germ.; *Désarticulation du Pied*, Fr.)

This operation was long since performed successfully in France, once by **Sedillier**, **de Lavall**, and **Brasdor**; but seems to have been given up from a notion that the projections of the ankles below the base of the shin-bone would prevent the scar bearing the weight of the foot, notwithstanding **Brasdor** had distinctly stated that these processes soon became blunted, that the ends of the bones rounded, and that there was plenty of skin to cover a great part of the wound.

Velpeau (*a*) performs this operation by making two semilunar flaps of skin, one upon the instep, and the other above the heel, twelve or fifteen lines before and behind the joint, and meeting to form another semilunar cut on each side about an inch below the ankles. The tendons and ligaments are then to be divided as close as possible to the joint; after which the *astragalus* is easily removed from its mortise, and with it the whole foot. The flaps are brought together transversely, so that the angles enclose the points of the ankles.

Baudens' operation differs from **Velpeau**'s in a single flap being made by carrying a knife down to the bone, from the insertion of the **Achilles**' tendon behind the heel, on each margin of the sole of the foot, nearly as far forwards as the crease of the toes, and these are connected by a transverse cut of a semicircular form like a gaiter across the whole dorsal surface of the foot, which must descend a little lower on the inner than on the outer edge, to avoid including a small bundle of muscular fibres belonging to the

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(*a*) Nouveaux Elémens de Médecine Opératoire, vol. ii. p. 497. 1832.

plantar surface. The flap thus marked is now taken hold of with the left hand and firmly drawn, so that with some smart strokes of the knife, the whole of the soft parts, including the plantar arteries, should be shaved off close to the bones, as far back as the points of the ankles. The anterior ligament is then cut through, and the line of the joint laid bare, but without opening it further, the saw is placed upon it, and worked from before backwards, so as not merely to remove the malleolar processes, but also the hind edge of the tibial mortise, in order to make the surface level, and leaving the joint-cartilage only in front and in the middle, so that it hardly forms a third of the whole bony surface. The ligaments and soft parts untouched are now to be separated with the knife and the ACHILLES' tendon scraped off as closely as possible to the heel-bone. The posterior and anterior tibial arteries require tying, and the flap dropping by its own weight upon the wound is fixed with sutures.

SYME (*a*) introduced the operation of amputation through the ankle-joint into this country, making his flaps like VELPEAU, and sawing off the malleolar processes, as in BAUDEN's amputation just above the joint, but not meddling with the base of the shin-bone, unless it be diseased. The removal of the bony projections of the ankles was a very happy thought, although BRASDOR's observation proves that they will become blunted, and SYME is justly entitled to the merit of having perfected this operation. In his first operation, he cut across the integuments of the instep in a curved direction, with the convexity towards the toes, and then across the sole of the foot, so that the incisions were nearly opposite each other. The flaps thus formed were separated from their subjacent connexions, which was easily done, except at the heel, where the firmness of texture occasioned a little difficulty. The disarticulation being then readily completed, the malleolar projections were removed by means of cutting pliers. Subsequently he thought these flaps too long (*b*), and states that a line drawn round the foot midway between the head of the fifth metatarsal bone and the *malleolus externus*, will show their extent anteriorly, and that they should meet a little way farther back, opposite the malleolar projections of the *tibia* and *fibula*. Care is to be taken to avoid cutting the posterior tibial artery before it divides into the two plantar arteries for fear of partial sloughing of the flap. If the articulating surfaces of the *tibia* and *fibula* be diseased, a thin slice of these bones should be sawn off.

HANDYSIDE (*c*) imagines that the operation can be much more easily and readily performed by the method of antero-lateral flaps, as the dissection of the *os calcis* from the soft part of the heel is thus much more easily effected, the great bruising and twisting of the soft parts, which occurs in the other mode of disarticulation, is thus happily avoided, and primary union is thus more likely to take place. The operation could, if necessary, be still further facilitated also by incising the pad of the heel backwards from the point where the two antero-lateral incisions meet. To this it may be fairly replied, that there is no necessity for twisting and bruising the soft parts, and that the side-flap proposal directly does away with one principal advantage of SYME's operation, to wit, that "the dense textures provided by nature, for supporting the weight of the body, might be still employed for the same purpose;" and on which account it should be pre-

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(*a*) Surgical Cases and Observations; in London and Edinburgh Monthly Journal of Medical Science, vol. iii. p. 93. 1843.

(*b*) Same; in same, vol. iv. p. 647. 1844.

(*c*) Cases in Surgery; in same, vol. v. p. 789, 1845.

ferred to the side-flap scheme. **Syme** considers this operation applicable to many diseases and injuries of the foot, in which, excision of the affected bones or amputation of part of the foot being inefficient, the practice previously followed had been that of amputating below the knee. The advantages promised by amputation at the ankle-joint instead of the operation near the knee are, *first*, that the risk of life will be smaller ; *second*, that a more comfortable stump will be afforded ; *third*, that the limb will be more seemly and useful for support and progressive motion. The risk of life must be less, because the parts divided and removed are not nearly so extensive as when the leg is amputated, hardly indeed exceeding those concerned in **Chopart**'s operation ; because there is less room for hæmorrhage either immediate or secondary, owing to the smaller size of the vessels cut, which are merely the branches of the posterior tibial, and the anterior tibial artery very near its termination ; and because the cavities of cylindrical bones not being opened, the danger of exfoliation from the dense osseous texture and of inflammation in the medullary veins is avoided. The stump will be more comfortable, because it is formed of parts peculiarly well calculated to protect the bone from injury, and not disposed to contract like the muscular tissue ; because the cut ends of the nerves being smaller, will be less apt to enlarge and become the seat of uneasy sensations ; and because the absence of exfoliation ensures complete union of the integuments over the bone, and the limb will be more useful, as well as seemly, from full play being afforded to the knee-joint, without the embarrassment of an imperfect stump. This operation has been successfully performed eight times by **Syme** himself, and also by several others.

II.**—OF EXARTICULATION OF THE TARSAL BONES.

I am rather doubtful whether this subject should be here noticed, or whether it should be referred to excisions; but upon the whole it may perhaps be considered as belonging rather to exarticulations.

The needfulness of removing or exarticulating either of the tarsal bones seems to be restricted to the *astragalus* and navicular bone in cases of compound dislocation ; but I have not known any instance in which the latter has been removed. In very rare instances the *astragalus* may be thrown out from all its connexions through the skin by violence ; a case of this kind occurred some years since to my late friend **Hammond** of Southgate, in which his patient having jumped out of a gig, with which his horse had run away, the *astragalus* was jerked completely through the skin on the front of the instep, and hung only by a few shreds of cellular tissue, which having been divided, the bone was removed and the patient recovered.

More commonly the *astragalus* is merely detached and thrown out from the cup of the navicular bone, which happened in a case of my colleague **Green**'s, several years since (*a*), the so-called head of the bone bursting through the skin below the inner ankle. If the bone cannot be replaced, it must be exarticulated from the ankle-joint above and from its connexion with the heel-bone below. The operation is tedious and tiresome, and it is requisite to cut through the remains of the inner plantar ligament and the other ligaments which connect the bone to the

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(*a*) A. Cooper, On Dislocations, p. 330. New Edition, 1842.

shin- and splint-bones, in doing which the point of the knife must be kept close to the *astragalus*, and, if possible, to avoid division of the plantar arteries if they be not already torn through.—J. F. S.]

III.—OF EXARTICULATION OF THE FOOT BETWEEN THE ASTRAGALUS AND NAVICULAR BONES, AND THE HEEL- AND CUBOID BONES.

(*Exarticulatio per Montem Pedis*, Lat.; *Ablösung des Fusses zwischen dem Sprung- und Kahnförmigen, und dem Fersen- und Würfelförmigen Beines*, Germ.; *Désarticulation Partielle du Tarse*, F.)

2777. Amputation of the foot through the nearly right lined joints between the *astragalus* and navicular, and the heel- and cuboid bones, indicated by Garengeot and Heister, was first performed by Du Viviers (*a*) and Chopart (*b*), but first described by the latter, whence its designation, Chopart's excision of the foot; and in Germany, specially, particular rules were laid down for it by Walther (*c*), and its great preference to the previously grievous amputation of the leg pointed out (*d*).

2778. The diseased conditions suitable for this operation are rare, and are only crushings and carious destruction not extending beyond the first row of the tarsal bones, and in which the state of the soft parts permits the formation of a flap sufficient to cover the exposed joint-surfaces.

2779. The mode of proceeding in this operation varies according as the condition of the soft parts permits the formation of *two* flaps or only *one*.

2780. The patient is placed in the same position as in amputation through the thigh. The femoral artery is compressed above the knee with a tourniquet: an assistant grasps the foot above the ankle, and draws the skin as much as possible upwards. The operator holds the front of the foot with his left hand, placing the tip of his forefinger on the prominence of the navicular bone, and the flat of his thumb behind the prominent end of the metatarsal bone of the little toe; and a line drawn across the dorsal surface of the foot, behind the thumb and forefinger, sufficiently points out the place of the joint. The operator in this way grasps the *right* foot of the patient with his own left hand, its palm being directed towards himself; but in operating on the *left* foot, the back of his hand is towards the operator. This indication of the joint is by far more certain than the direction to find it, a finger's breadth beneath the lower end of the shin-bone, or half an inch below the outer, or an inch below the inner ankle.

2781. If *an under flap only be to be formed*, the fingers of the left hand having been placed as directed, a strong scalpel is to be carried immediately behind them from the one edge of the foot, about four or five lines above the sole of the foot, over the instep to the opposite side, and the skin and tendons cut through. The first cut generally opens part of the joint. The front of the foot, then grasped with the left hand, the thumb upon the back and the other fingers upon the sole, is borne downwards and outwards, so as to stretch the ligaments between the *astragalus* and navicular bone, and then the knife is carried into the joint between

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(*a*) For Du Vivier's Case, see Hunczovsky, Medicinisch-chirurgische Beobachtungen auf seinen Reisen, p. 244. Wien, 1783.

(*b*) Fourcroy's Journal; La Médecine éclairée par les Sciences physiques, vol. iv. Paris, 1792.—Richter's Chirurg. Bibliothek, vol. xiv p. 471.—Dictionnaire des Sciences Médicales, vol. i. p. 497.

(*c*) Abhandlungen aus dem Gebiete der prakt. Medicin, u. s. w., p. 143.

(*d*) Langenbeck, Bibliothek für Chirurgie, vol. iii. p. 746, pl. i. fig. 1, 3.—Klein, above cited, p. 27.—Chelius, Bericht über die Chirurg. Klinik, p. 20.

them. As this is done the whole foot is drawn more downwards, and the ligaments between the heel- and cuboid-bones divided. The front of the foot is now much pressed down, a large amputating knife entered into the joint, and the inner being held a little higher than the outer edge of the foot, carried down with the edge close to the plantar surface of the metatarsal bones, cutting the flap obliquely downwards at their junction with the *phalanges* of the toes. In this way a flap is formed of proper length without any measuring being required.

2782. After tying the vessels and cleansing the wound, the flap is brought over the joint surfaces of the *astragalus* and heel-bone, so that its edge may be properly applied to that of the upper cut, and in this position it is to be fixed with sticking plaster passing from the sole over the instep, and from the one side of the flap to the other. Four compresses are then to be fastened with a circular bandage on the four sides of the stump, of which two are cleft, so that one cleft and one not cleft are opposite each other. The wound is now to be covered with a pledget and lint, the uncleft compress passed through the cleft one, drawn together diagonally and its ends fastened by some turns of the circular bandage.

2783. If *an upper and under flap be formed*, the joint having been determined as above mentioned, one cut is made on the inner edge of the foot, from the projection on the navicular bone, and a second on the outer side, beginning from the junction of the heel and cuboid bone; and the length of these cuts is to be from two to three fingers' breadth, according as the lower flap is formed larger or smaller. The lower ends of the side cuts are to be connected by a transverse one across the instep, and thus the flaps are to be separated together with all the tendons and muscles from the bones up to the beginning of the side cuts, and turned back. The prominence of the navicular bone is now again felt for, the foot grasped, as in the former case, with the left hand, and at the edge of the turned-back skin, close behind the projection of the navicular bone, the connexion between it and the *astragalus* is cut through, and then whilst the front of the foot is much pressed down, the connexion between the cuboid and the heel-bone is also cut through. The under flap is then formed with the large amputating knife in the way directed in the last paragraph.

If the above-mentioned indication of the joint be properly followed, it cannot be well missed. It may here be remarked to the little experienced, that in dividing the connexions between the navicular bone and *astragalus*, the knife frequently enters behind the head of the *astragalus*. If the knife be passed between the navicular and cuneiform bones, which is only possible by complete departure from the rules laid down, the mistake is soon discovered by the joint-surfaces of the cuneiform bones, and by the obstacle which the cuboid offers to its complete separation.

Maingault (*a*) begins the operation by forming the under flap, cutting through the tough ligaments on the plantar surface, and completing the operation by dividing the parts on the instep.

2784. Langenbeck, Klein, and Richerand consider the formation of an upper flap useless, because the higher the scar is with a single under flap, the less injury is it exposed to, and because this flap on account of its great toughness is more fit for covering the wound. Some consider that the upper flap should merely be formed by dissecting back the skin, as the tendons are liable to a tiresome suppuration and may be thrown off.

Experience has, however, proved to me that by the formation of an

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(*a*) Bulletin des Sciences Médicales. Nov., 1829; p. 60.

upper flap according to WALTHER's method, that is, when everything is separated from the bones, such adhesion of the tendons, especially of the *m. tibialis anticus*, will follow; that the heel cannot be so far drawn up by the operation of the gastrocnemial muscles as in the formation of a simple plantar flap or of an upper flap merely of skin. If after this operation the heel be considerably drawn up, the foot will be little useful for walking; and under such circumstances the subcutaneous division of the *tendo* ACHILLIS has been recommended.

SCOUTETTEN's *oval cut* only remains to be mentioned, in which from the middle of the line of the joint upon the instep, a cut is made passing forwards and downwards towards the roots of the metatarsal bones, and connected by a transverse cut upon the sole of the foot in the region of the bases of those bones. The skin is then drawn back, and the exposed joint divided. BLASIUS recommends his oblique cut.

IV.—OF EXARTICULATION OF THE METATARSAL BONES.

(*Exarticulatio inter Tarsum et Metatarsum*, Lat.; *Ablösung der Mittelfussknochen aus ihrer Verbindung mit den Fusswürzelknochen*, Germ.; *Désarticulation des Metatarsiens*, Fr.)

HEY, WILLIAM, Practical Observations in Surgery, p. 547. Second Edition.

VILERME, Sur les Amputations partielles du Pied; in Journal de Médecine, par LE ROUX, etc., vol. xxxii. p. 156. 1815.

LISFRANC DE ST. MARTIN, Sur l'Amputation partielle du Pied. Paris, 1815.

FICKER, Ueber die Amputation des Fusses zwischen der Fusswurzel und Mittelfussknochen; in VON GRAEFE und VON WALTHER's Journal für Chirurgie und Augenheilkunde, vol. iv. p. 90.

SCOUTETTEN, Mémoire et Observations sur l'Amputation partielle du Pied dans l'articulation tarso-metatarsienne; sur l'Amputation metacarpo-phalangienne en totalité, et Réflexions sur l'Amputation phalango-phalanginienne; in Archives générales de Médecine, vol. xiii. p. 54. 1827.

2785. The metatarsal bones may be removed from their connexion with the tarsal bones either all together or singly. The *first operation* should always be performed if the destruction do not extend over the tarsal bones, and the advantage of this operation is greater than CHOPART's excision, as thereby a larger portion of the foot and the insertion of the *m. tibialis anticus* is preserved, and the drawing back of the heel prevented. But if the greater difficulty of this operation be considered on account of the irregularity of the joints, and the impossibility of closely applying the flap, and that by the peformance of CHOPART's excision, according to the mode recommended by WALTHER, the drawing back of the heel can be prevented, this preference may seem less considerable.

2786. HEY first makes a mark upon the back of the foot, at the connexion of the metatarsal with the tarsal bones, and an inch beyond this a transverse cut through the skin and muscles of the bones of the *metatarsus*. From each end of this, he carries a cut along the inner and outer edge of the foot towards the toes, separates the skin from the metatarsal bones, and all the integuments and muscles forming the sole of the foot, from the under part of the *metatarsus*, with the edge of the knife close to the bone, up to their joints, detaches the four lesser metatarsal bones at this joint, and saws through the projecting part of the first cuneiform bone connected to that of the great toe. After the blood is stanched, the flaps are brought together with sutures.

Scoutetten, also, directs that the first cuneiform bone should be sawn off; the operation of the *m. tibialis anticus* is not thereby interfered with.

2787. According to Lisfranc, the operator, after having ascertained the position of the parts, grasps the fore part of the foot with his left hand, and with his right the catlin, then places, if he operate on the *right* foot, the hind part of its edge behind the projection of the fifth metatarsal bone, so that the edge forms a right angle with the axis of the joint; he divides the soft parts from without inwards, and a little from above downwards, and when he feels he has penetrated into the joint of the *metatarsus* with the cuboid bone, he raises the handle of the knife and passes through the first two joints with the point held vertically, then through the third joint, when he inclines it towards the toes, for the purpose of getting round the outer projection of the third cuneiform bone. He then finishes the division of the soft parts above by a cut which ends beneath the inner projection of the first metatarsal bone. He divides the cellular connexion if the retraction of the skin be not sufficient. The hand of the operator is held prone, and with one cut before and another behind, he gets round, with short strokes from before backwards, the projection just mentioned, finds the joint at about the distance of a line, where it is distinguishable by the absence of any obstacle, and by a little depression; he readily passes through this by describing a slight curve, the concavity of which corresponds to the cuneiform bone. Without giving the foot any other direction, and without the blade of the knife leaving the joint, the operator directs it, held in the same position it had in passing over the inside of the first metatarsal bone, between that bone, the first cuneiform, and the second metatarsal bone; he inclines the handle of the knife forwards so that its point may penetrate deeper, and then raises the handle suddenly towards the *tarsus*, so as to divide the ligaments. He proceeds to the hinder articulation, which he dislocates a little, brings the edge of the knife in a transverse direction, and ends by dividing the connexion of the second metatarsal bone with the third cuneiform, by an opposite movement to that which had divided the connexion of the first metatarsal with the first cuneiform bone, taking care to bring the point of the foot slightly inwards. Attention in using only the point of the knife in the exarticulation has the advantage of not injuring the soft parts in the sole, and of penetrating more easily between the bones. The operator continues the operation by dividing the hinder ligaments, holding the parts to be removed, vertically, and not much dislocated. He then carries the whole edge of the knife forwards, close to the hinder edge of the metatarsal bones, and forms a flap from the sole of the foot, two inches long on the outer and inner side, and thick in front, so that it readily unites. After tying the vessels and cleansing the wound, the flap is brought up over the surface of the wound, kept in its place with sticking plaster, covered with lint and compress, and supported by a moderately tight bandage. The foot is now placed in a rather raised position upon a pillow in the bed, the leg half bent and laid on its outer side, so that the discharge from the wound may readily escape.

If the operation be performed on the *left* foot, the operation must be begun on the inside of the foot, and the above-mentioned directions of the knife must be followed out.

2788. Münzenthaler (*a*) gives the following description of this operation. The operator, placed on the inside of the limb, passes his

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(*a*) Above cited, p. 29.

finger to the bone which bounds the *tarsus*, glides it from the toes to the ankle and acquaints himself with the projections which the connexion of the metatarsal and tarsal bones form at some parts. He marks the place of the joint with the thumb and forefinger of the left hand, places the edge of the knife behind the hind end of the fifth metatarsal bone, passes over the dorsal surface of the foot, at first from behind forwards, then from before backwards, and thus makes a semicircular cut which ends half an inch before the pit observed at the side of the joint of the cuneiform with the metatarsal bone. The knife is brought back again into the wound from within outwards, whilst an assistant draws the skin back towards the ankle, and thus the extensor tendons of the toes of both the *m. peroneus longus* and *brevis*, the artery, and so on, are cut through. The operator now brings the point of the knife vertically behind the hind end of the fifth metatarsal bone, directs it inwards and forwards, cuts through the joint of the two last metatarsal bones, and divides the ligaments transversely. He now leaves this part and turns to the inside of the foot, and here directing the point of the knife upwards, and its edge outwards, cuts through the ligaments from below upwards, and from behind forwards, and penetrates the space between the bones, in the direction of a line running to the middle of the fifth metatarsal bone. To disjoint the second metatarsal bone, the knife performs a rotatory movement, and its edge is directed forwards. The operator brings the point obliquely from below upwards, between the great cuneiform and the second metatarsal bone, and divides the soft parts near its inner edge, then raises the handle of the knife, cuts through the ligaments, and thus gets to the hind part of the mortise which the second forms with the other cuneiform bones. He now again, holding the knife as usual, directs the point from without inwards, and cuts through the dorsal ligaments without penetrating the joint; for the separation of the upper surface of the bones thereby connected, a slight pressure of the left hand upon the end of the foot is sufficient. If the fibrous parts oppose the dislocation of the metatarsal bones they must be gradually cut through. The foot is now to be held horizontally between adduction and abduction, and the Surgeon cuts through the plantar ligaments of the joint, separates the soft parts from the hinder ends of the *metatarsus*, carries the knife round them, cuts close to the lower surface of the row of bones, and forms, by cutting out obliquely, a flap, which on its inner side is two, and on the outer side, only one inch long.

If the *left* foot be operated on, the operator stands on the outside of the limb, cuts from the tibial to the fibular edge, and proceeds with the operation as directed.

If the projection of the fifth metatarsal bone cannot be properly made out, a point two inches before and below the outer ankle, will sufficiently distinguish it. The projection on the first metatarsal bone, if it cannot be felt, will be found nine lines below a line supposed to be drawn from the prominence of the fifth metatarsal bone, directly to the inside of the foot.

If the operation be performed on a young person before puberty, where the projection formed by the first cuneiform bone is still cartilaginous, this process should be cut through with the edge of the knife almost in the same line in which the joints of the second, third, and fourth metatarsal bones are found.

2789. Of the exarticulation of the single metatarsal bones, must be considered, *first*, the exarticulation of the three or four outer metatarsal bones, whilst that of the great toe is preserved: *second*, the exarticulation of the great and little metatarsal bones: *third*, the exarticulation of one of the middle metatarsal bones.

2790. The preservation of the great toe, when the other metatarsal bones are removed, is a great advantage to the patient. A cut should be made in the space between the great and second toe, and a second along the outer edge of the foot, and both connected at one or two fingers' breadth below the tarsal joint on the instep; the skin is then drawn back, and the joint opened from the outer edge of the foot, after which a large flap is cut from the sole (*a*).

The outer two metatarsal bones are removed in the same way.

2791. The *exarticulation of the metatarsal bone of the great toe* is performed most conveniently, in the following way:—A small amputating knife is entered on the outer side of the great toe, at a stroke, through the soft parts, between the metatarsal bone of the great and second toe up to the joint of the former, with the cuneiform bone. Then the metatarsal bone of the great toe being drawn inwards, the whole edge of the knife is carried into the joint, and whilst this is done the great toe is pressed forcibly inwards, till the metatarsal bone is completely dislocated. The edge of the knife is then carried round the joint-surface, and being kept close to the outer side of the metatarsal bone at its connexion with the great toe, forms a flap sufficient to cover the whole surface of the wound. The dressing is like that in amputation through this bone.

2792. If the state of the soft parts will not allow the formation of a side flap, a lower or upper flap must be made in the same way as in amputating through the bone (*par.* 2729) after a longitudinal cut has been made on the outside of the metatarsal bone of the great toe. Or LANGENBECK's or SCOUTETTEN's method may be adopted; though the operation is then more tedious and difficult. When the situation of the joint has been found by feeling with the finger, and the place (*par.* 2788 *note*) marked, the point of the left forefinger is put on this part, and the other fingers, excepting the thumb, placed on the sole, for the purpose of supporting the foot. A cut is now made, beginning two lines behind the joint, and continued obliquely, from within outwards to the commissure of the toes, to the base of the first *phalanx* opposite the crease of the joint, on the sole. This cut is now left, and the bistoury, placed on the inside of the *phalanx* at the lower angle of the cut, is carried up along the inner side of the toe and metatarsal bone, obliquely from within outwards, to the beginning of the cut. After dividing the skin, the knife is carried anew into the wound, and successively cuts through the tendons, muscular fibres, and skin on the sole of the foot, leaving the two sesamoid bones attached to the joint, and separates from the metatarsal bone the skin attached to its inner side. The joint is now again sought for and opened, the point of the bistoury being held vertically, and the edge a little obliquely from within outwards, and from behind forwards. As the internal ligament is divided, the knife is drawn backwards, and the undivided fibres of the upper ligament cut through, whilst the edge of the knife is directed upwards, and the point sunk obliquely at an angle of 45° in the space between the first cuneiform, and the second metatarsal bone. The knife, of which the point has been thrust down to the sole of the foot, is raised to a right angle, and by this movement, the fibres of the interos-

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(*a*) KEY; in Guy's Hospital Reports, vol. i. p. 244. 1836.

seous ligament are cut through, and the metatarsal bone, still a little attached, is to be completely separated and removed.

If the operation be performed on the right foot, the place of the joint must be found with the forefinger of the right hand, and the left forefinger placed there to point it out, and whilst with the other fingers the foot is held, grasping its outer edge, the first cut is made on the inside.

2793. In *exarticulation of the metatarsal bone of the little toe*, the proceeding is the same as in the former case. That of the little and fourth toe is performed, according to SCOUTETTEN, by the same method as for removing the metatarsal bone of the great toe.

2794. The *middle metatarsal bones may be removed* from their connexion with the tarsal bones, according to SCOUTETTEN, by the oval cut, which is preferable to the method with two side cuts.

In these exarticulations of the metatarsal bones, the affected tarsal bones may be also at the same time removed. KEY removed at once the outer four metatarsal bones, the second and third cuneiform, and the cuboid bones. DIEFFENBACH (*a*) took away the outer two metatarsal and cuboid bone; and in another case, the inner two with the two cuneiform and the navicular bone. RUYER (*b*) in an exarticulation of the first metatarsal, removed also the first and second cuneiform bones.

V.—OF EXARTICULATION OF THE TOES.

(*Exarticulatio Digitorum Pedis*, Lat.; *Exarticulation der Zehen*, Germ.; *Désarticulation des Orteils*, Fr.)

2795. In *exarticulation of the toes from their connexion with the metatarsal bones*, an under, upper, or side flap, or the oval cut, may be made according to the state of the soft parts.

2796. If an *under flap* have to be formed, after the situation of the joint is determined, a transverse cut should be made over its upper surface, which divides the front and part of the side connexions of the joint. From both angles of this cut on either side of the toe a cut descends, dividing the side connexions of the joint. The toe is then pressed downwards to dislocate it, the connexions behind are divided, the knife carried along the under surface of the bone, and the flap made through the side cut. After the bleeding has been stanched, the flap is brought over the surface of the wound, and kept in place with straps of plaster.

In forming the *flap upon the dorsal surface*, a longitudinal cut is made on each side, with the knife held horizontally, beginning from the joint and continued to the junction of the first with the second *phalanx*. These side cuts are connected by a transverse one across the dorsal surface, and the flap separated up to the joint, into which, whilst the toe is pressed downwards, the knife is carried, and all the ligaments and soft parts cut through.

2797. If an *outer or inner flap* have to be formed on the great or little toe, the toe must be drawn in the opposite direction, the knife pressed on the outer or inner side, directly into the joint, carried round the joint surface of the first *phalanx*, whilst the toe is dislocated, and a large flap sufficient to cover the wound formed on the outer or inner side by carrying the knife along the bone.

With the other toes, the side flaps are formed by two semilunar cuts carried from the upper part of the joint over the side of the toe which is

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(*a*) Hamburger Zeitschrift, vol. i. part i.

(*b*) Revue Médicale, 1832; vol. iv. p. 187.

turned down, and the first *phalanx* dislocated, after the flap has been turned back.

To prevent the protrusion of the head of the metatarsal bone in exarticulation of the great and little toes, **Dupuytren** saws off the head with a fine saw.

2798. In *exarticulation of the second from the first phalanx*, that which is to be removed must be bent backwards, a transverse cut made directly into the joint, and all the soft parts divided to its hind surface. The *phalanx* is now dislocated, the knife carried round the joint, and the flap made from the soft parts below sufficient to cover the wound. It is, however better when only one *phalanx* is to be removed, to exarticulate the whole toe, because the remaining stump is inconvenient.

2799. If *all the toes have to be exarticulated at once*, a semilunar cut must be made on the dorsal surface from the great to the little toe, or the contrary, through the general coverings, the joints opened and the knife carried forwards and downwards opposite to and through the crease of skin which bounds the sole of the foot in front.

2800. In exarticulation of the toes from their connexion with the metatarsal bones, the position of the joint having been, according to **Scoutetten**, ascertained by moving the toes, the point of the bistoury is to be placed a line behind the joint, and carried to the base of the toe along the crease in the skin there existing. The bistoury is now again entered from the other side into the end of the first cut, and carried upwards around the toe to the beginning of that cut. It is then passed through the whole wound to cut through whatever remains attached, and the tendons of the extensor muscles; and an assistant lifts up the *phalanx*, whilst the cellular tissue surrounding the joint, and the sheath of the tendons of the flexor muscles are divided; the *phalanx* is then grasped with the fingers of the left hand, and operation completed by division of the lateral ligaments.

VI.—OF EXARTICULATION OF THE ARM AT THE SHOULDER.

(*Exarticulatio Humeri*, Lat.; *Ablösung des Oberarmes aus dem Schultergelenke*, Germ.; *Désarticulation du Bras*, Fr.)

La Faye; in Mémoires de l'Académie Royale de Chirurgie, vol. ii. p. 239.

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Larrey, Mémoire de Chirurgie Militaire, vol. ii. p. 166; vol. iii. p. 354; vol. iv. p. 427.

Guthrie, above cited, p. 420.

Klein, above cited, p. 1.

Maingault, above cited.

Ammon, Parallele der französischen und deutschen Chirurgie, p. 235.

2801. *Amputation of the upper-arm at the shoulder-joint* is the easiest of the extirpations from the great joints. It was first performed by the elder **Morand**. Of the several modes recommended for performing the operation, the following may be considered the most important; *First*, the formation of an upper and under flap; *Second*, the formation of two side flaps; *Third*, the circular; and, *Fourth*, the oval cut.

2802. The patient either sits on a stool, or lies on a table covered with a mattress, with the side to be operated on turned to the light, and is to be properly held by assistants. The subclavian artery is to be compressed by an assistant standing behind the patient, either with his fingers or with a compressor (**Ehrlich**'s) against the first rib.

The pressure upon the subclavian artery by an assistant is better than the application of **Dahl** or **Mohrenheim**'s compressor. When the collar-bone is considerably raised pressure upon the artery is often safer beneath the collar-bone, in the pit between the edges of the *m. deltoides* and *m. pectoralis*. **Richerand** (*a*) thinks compression of the subclavian artery unnecessary, and only compresses the axillary artery, just before cutting through the hinder flap.

2803. The *formation of an upper and under flap*, as recommended by **La Faye**, **Richerand** and others, has been very carefully laid down by **Walther**. The upper-arm to be removed, is brought to the side of the chest and there held by an assistant. A small amputating knife is to be thrust in, at the outermost tip of the coracoid process, up to the bone, its edge sunk along the inner edge of the deltoid muscle and carried down to its insertion, cutting through all the flesh to the bone. A second cut parallel to this is carried from the outer upper angle of the blade-bone down also to the insertion of the deltoid muscle. The two lower angles of these wounds are to be connected by a transverse cut down to the bone. The flap described by these three cuts is now separated from the bone up to the beginning of the two side cuts, turned back and held by an assistant, who at the same time compresses the divided circumflex humeral artery, if it be not at once tied. The upper-arm is now grasped with the left hand, brought into a state of complete adduction, so that the tendons of the muscles passing from the blade-bone and hind region of the chest over the shoulder-joint to the upper-arm, and the outer side of the capsular ligament are made tense. The thumb being then placed on the head of the bone, a convex scalpel held with the whole hand cuts through with a smart stroke all the parts covering the head, which being rolled outwards and backwards, tightens the inside of the capsular ligament and the tendons passing over the shoulder-joint, and these are divided with repeated strokes of the knife. The arm being now brought against the trunk and raised, the head of the bone protrudes out of the joint; the whole of the amputating knife is then passed in behind it, and cutting through the still undivided ligaments is carried, with its edge to-

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(*a*) Nosographie Chirurgicale, vol. iv. p. 511. Edit. of 1815.

wards the bone, down on its hinder surface, and the under flap formed, as it cuts out obliquely downwards about four fingers' breadth below the joint; before doing which, an assistant grasps the flap and compresses the artery.

After stanching the bleeding and cleansing the wound, the two flaps are brought together and fastened with sticking plaster; lint and compresses are then put upon the stump and confined with a body-bandage, the middle of which upon the shoulder has a hole in it through which the sound arm can be slipped.

The earlier methods of **Le Dran** and **Garengeot** need only be mentioned as matters of history; they first took up the axillary artery with a straight or curved needle, two fingers' breadth below the armpit, then with a transverse cut three fingers' breadth below the *acromion*, they divided the skin and deltoid muscle, and after separating the head formed an under flap.

2804. According to **Dupuytren** (*a*), the arm should be raised and held at a right angle with the body. The operator placing himself on the inside of the arm, grasps and lifts up the deltoid muscle with the one hand, thrusts a double-edged knife through it from within outwards, taking care that its blade never slips from the head of the bone. The knife with its edge towards the bone is drawn downwards, and the upper flap formed by cutting obliquely outwards. The rest of the proceeding corresponds with that above described, only that the operator holds the flap before he cuts it through.

Here must be mentioned **Onsenoort**'s method. By means of a knife curved towards its surface, a transverse cut is made an inch and a half above the insertion of the deltoid muscle; the knife with its concavity on the bone is pushed up to the *acromion*, penetrates the joint, and by its concave side being drawn down upon the bone the under flap is cut off, so that by a continued stroke of the knife the two flaps are formed.

2805. **Lisfranc** and **Champesme** proceed in the following manner. The arm is brought to the side and left to itself. The operator standing in front of the shoulder drops the point of a narrow double-edged knife into the triangular space between the coracoid process and front edge of the *acromion*, and carries it from before to behind through the joint, so that it passes out half an inch below the part where the *acromion* rounds. The knife is then carried from above and before around the head of the upper-arm bone and a flap formed from the deltoid, as in **Dupuytren**'s method. This flap being lifted up by an assistant, the capsular ligament is found opened, and the whole knife being carried in behind the head, the lower flap is formed as after **La Faye**'s mode.

If the left arm be operated on, the knife is to be used with the left hand, or being held with the right hand, is thrust in at the back of the joint, where it has been mentioned as coming out, in the method already described, and out at the triangular space, by the coracoid process.

[**Astley Cooper**'s (*b*) amputation at the shoulder-joint "with a single flap," as he calls it, and which he prefers, differs little from the last-described operation, except in the flap of the deltoid muscle being made from below and up into the joint. "The subclavian artery is to be compressed upon the first rib, from above the clavicle, by an assistant. The ring of a common key covered with some soft linen, is a convenient instrument for this purpose. The patient should be seated on a low chair, and the arm to be removed should be elevated a little from the side by an assistant. In making the single flap, the Surgeon raises the deltoid muscle with the fingers and thumb of his left hand, and introducing the catlin through the integument, and under the muscle, near its insertion, he cuts upwards close to the *os humeri*, as far as the under part of the *acromion* process; the integument and larger part of the deltoid muscle are thus raised, so as completely to expose the outer part of the shoulder-joint; the arm being then drawn down-

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(*a*) Dictionnaire des Sciences Médicales, vol. i. p. 496.

(*b*) Lectures, by **Tyrrell**, vol. ii.

wards, the catlin is passed into the joint, at the anterior part, so as to divide the tendon of the *biceps* muscle, and afterwards is carried round the head of the bone to cut through the capsular ligament. The separation of the limb may be completed either by passing the knife over the head of the bone, and cutting downwards to the *axilla*, or by placing the knife in the *axilla*, and dividing upwards to the joint; in either case the amputation should be finished by one stroke of the catlin." (pp. 429, 30.)]

2806. The elder Hesselbach's (*a*) method differs from those already described in forming the under flap first. The patient sits on a stool, and the operator standing before him, with his left hand grasps the upper-arm beneath the insertion of the deltoid muscle, and rolling it outwards, so as well to distinguish the coracoid process from the little tubercle on the head of the upper-arm-bone, thrusts a long, narrow, double-edged knife near the coracoid process, obliquely outwards up to the head of the bone, so as at once to open the joint; the knife then carried, with its point close on the bone, down to the lower edge of the great pectoral muscle, cuts through its tendon and that of the subscapular muscle, the acromial thoracic and anterior circumflex humeral arteries. He then rolls the head of the bone inwards, thereby rendering the hind muscles tense, and draws it as much as possible from the blade-bone, whilst at the same time he presses the lower end of the upper-arm-bone against the chest. He now carries the knife between the head of the bone and the joint-surface of the blade-bone, through the joint, thrusts, whilst he drops the handle of the knife a little, through the hinder thin part of the deltoid muscle, below the *acromion*, and carrying the knife down close to the bone, forms the under flap, the vessels in which being at the same time compressed by an assistant. The head of the bone is now pressed downwards, by an assistant, out of the opened capsular ligament, as the elbow is separated from the trunk, and the whole knife being placed above the head of the bone, is carried with its edge towards the bone, to the end of the first flap, and forms the upper flap.

2807. Desault (*b*) has given the following directions for *forming an inner and an outer flap.* A double-edged straight amputating knife is thrust from before, into the joint, and after its point has passed on the inner side of the upper-arm, through the arm-pit, drawn down close to the bone for three fingers' breadth, and thus a flap is formed containing the vessels, which an assistant grasps, and compresses. The whole knife is then carried round the head of the upper-arm-bone, and forms a corresponding external flap.

Larrey (*c*) forms the outer flap first, penetrating from without into the joint, and ending by the formation of the inner flap, so that if proper assistance be wanting, as for instance, in the field, there may be greater safety against bleeding.

Larrey (*d*) has more recently described his method in the following way. A longitudinal cut is made, beginning from the edge of the *acromion*, and carried down about an inch below the neck of the *humerus*, which divides the deltoid muscle into two equal halves. By the help of an assistant the skin of the arm is drawn back towards the shoulder, and two flaps, a fore and hind one, are formed by two cuts passing obliquely from within outwards and downwards, so that the tendons of the *m. pectoralis* and *m. latissimus dorsi* are included in the two cuts. There is no fear of injuring the axillary vessels, because they lie beyond the reach of the point of the knife. The cellular connexions of both flaps are now divided, and they are drawn up by an assistant, who at the same time compresses the circumflex arteries. The whole shoulder-joint is in this way laid bare, and with a third cut carried over the head of the bone, the capsular

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(*a*) Oberteuffer, above cited.
(*b*) Haselberg, above cited.
(*c*) Above cited, vol. ii. p. 170.
(*d*) Above cited, vol. iv. p. 427.

ligament and tendons are divided. The head of the bone is now moved a little outwards, and the knife carried down close to the hind surface of the bone for the purpose of completely dividing the tendinous and ligamentous connexions at this part. The assistant now places the forefinger of both hands immediately upon the brachial *plexus* for the purpose of compressing the artery; and the edge of the knife being turned backwards, cuts opposite the lower angle of both flaps, through the whole bundle of axillary nerves before the two fingers of the assistant.

Langenbeck (*a*), after drawing down and pressing the arm against the chest, makes with a small knife a cut into the deltoid muscle, so that the head of the bone may be conveniently dislocated, carries the knife behind it, and forms on the inner surface of the upper arm a sufficiently large flap, in doing which, the edge of the knife is carried down close to the bone, the head of the bone grasped and drawn towards the operator, so that the axillary artery may not be cut off too high. Dupuytren's (*b*) method corresponds with this.

2808. The *exarticulation of the upper arm with the circular cut* is variously performed.

Morand made a circular cut in the skin, drew it back, and then cut through the muscles close to the head of the bone, exposed it and divided the ligaments.

Sharp proceeded in like manner, only he first laid bare the axillary artery by a longitudinal cut and tied it.

Nannoni and Bertrandi first made a transverse cut three fingers' breadth below the *acromion*, through the skin and deltoid muscle, and drawing them back cut into the capsular ligament, dislocated the head of the bone, and after tying the axillary artery, cut through the armpit (1).

Alanson made a circular cut a hand's breadth below the *acromion*, through the skin, and with the edge of the knife directed obliquely upwards, through the muscles, and afterwards, for the more easy division of the joint, he made a straight cut through the upper part of the deltoid muscle.

Graefe (*c*) lays down the following rules for his funnel-shaped cut (*Trichterschnitt.*) The arm being held nearly horizontally, the cut through the skin is made three fingers' breadth below the *acromion*, and then the cut through the muscles with his leaf-knife, pressed obliquely upwards to the head of the bone. An assistant draws the muscular mass upwards with both hands, and then, the head being rolled forwards and upwards, the capsular ligament is opened, first, on the fore and upper, and afterwards, upon the upper and back part of the head with the leaf-knife, held obliquely; the tendon of the *m. biceps* is cut through, the arm drawn by the operator towards himself, and the head being thereby dislocated, the under hinder part of the capsular ligament is divided. The vein is to be also tied, and the wound brought together in a vertical direction with one suture.

(1) Cornuau and Sanson's method agrees precisely with this, only that the former makes the semicircular cut through the deltoid muscle, of four fingers' breadth, and the latter only a finger's breadth below the *acromion*. Velpeau's (*d*) method is the same.

Benj. Bell's (*e*) operation consists in one circular cut at the point of the deltoid muscle through the skin, and a second through the muscles, and tying the artery; then two longitudinal cuts, in front from the *acromion*, and behind from the top of the shoulder, run down into the circular cut, after which the flaps thus formed are separated from the bone and its head set free.

2809. In *exarticulation of the upper-arm with the oval cut*, Scoutetten (*f*) proceeds in the following manner:—The operator, having satisfied himself of the situation of the *acromion*, grasps, if operating on the

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(*a*) Bibliothek für die Chirurgie, vol. iv. p. 505

(*b*) Leçons Orales, vol. iii. p. 328.

(*c*) Above cited, p. 110, pl. ii. and iii.

(*d*) Médecine Opératoire, vol. i. p. 39.

(*e*) Above cited, vol. vi. p. 417.

(*f*) Above cited, p. 15, pl. i. and ii.

left arm, the middle of the upper-arm with the left hand, brings it about four or five fingers' breadth away from the trunk, and thrusts a pointed knife, immediately below the *acromion*, up to the head of the *humerus*. The edge of the knife is now sunk deeply, carried downwards and inwards, and thus the first cut is completed, which stretches down four fingers' breadth from the *acromion*, and upon the bone divides the hind third of the deltoid muscle and the greater part of the fibres of the long head of the *m. triceps*. The operator now places the knife, with its point downwards, on the inside of the arm, and beginning the second cut upon the other side of the *m. triceps*, at the same height as the end of the first cut carries it inwards and upwards to the *acromion* where it meets with the former. In order to lay bare the joint better, that part of the deltoid muscle attached to the *humerus* may be a little separated, and the edges of the wound drawn apart by an assistant. The upper-arm is now to be moved about in different directions, and the tendons and capsular ligament, being divided together, the head of the bone is lifted out of the joint, and the arm being pressed towards the body, the whole knife is carried round it close to the bone, the humeral artery compressed in the wound by an assistant, and the still undivided parts, containing the vessels, cut through.

When the right arm is operated on, the first cut must be made from the inside of the joint up to the *acromion*, but, in other respects, the operation is the same.

In like manner DUPUYTREN and BECLARD proceed. They form from the middle of the top of the shoulder two semilunar cuts running downwards, and ending before the *plexus*. The flaps thus formed are turned back, the joint opened, the knife carried behind the head downwards, and the flap containing the vessels, which are compressed by an assistant, divided.

BONFILS (*a*) begins his first cut between the coracoid process and the *acromion*, and the second, not in the beginning of the former, but two inches lower, so as to form a larger hinder flap, with which the joint-surface can be better covered.

BLASIUS's oblique cut may also here be mentioned.

2810. As regards the choice of the above-mentioned methods for exarticulating the upper-arm-bone, the following circumstances must be attended to. It must here be considered, as in every other exarticulation, in what way the soft parts are injured, whether the bone be broken, and whether the arm be more or less movable. The method of operation must be directed by these circumstances, and the formation of the flaps undertaken in such way as the condition of the soft parts allows, and, as is necessary to cover the wound properly. The modification of LA FAYE's method by WALTHER and DUPUYTREN is, in general, most fitting; at least, in certainty and readiness of execution it surpasses all other. The objection of the more tedious and difficult healing, on account of the flaps, the base of which corresponds to the greater diameter of the joint, not fitting well; on account of the obstacle to the escape of the pus, and so on, is contradicted as well by my own experience as by that of others, and is no reason for preferring the vertical wound with an outer and inner flap.

The quickness in performing LISFRANC's and HESSELBACH's operations is not, indeed, to be denied; but in living persons where the parts about the joint are often swollen and variously altered, the arm little or not at all movable, and the head of the upper-arm-bone firmly drawn into the

(*a*) Journal de Médecine, vol. xcvi. p. 192. 1826.

socket by the contraction of the muscles, this method is, for beginners especially, in most cases unsafe. The point of the knife is easily caught, must be carried inwards and forwards in various ways, and the like. Beginners find out that here, as in many other of the modes of exarticulation proposed in modern times, sleights of hand, which are readily performed upon the dead body, are unavailable in cases of necessity. **Langenbeck** (*a*) has already justly objected to **Graefe**'s method, that the knife with its edge turned outwards is not fit to be rolled about, and, especially in the extended position of the arm, that the much-stretched axillary artery would be cut through too near the shoulder-joint, and might retract so greatly as to cause great difficulty in tying it.

2811. When, after exarticulation of the upper-arm-bone, the *acromion* or the glenoid cavity is in any way injured, so that its removal may be considered necessary, it is easily done with the saw (*b*). **Brown** sawed off the projecting *acromion*, for the purpose of making an insufficient quantity of skin better cover the wound. **Robinson** (*c*) recommends removal of the *acromion* and the glenoid cavity, so that the stump may be made rounder and more regular. **Fraser** (*d*) also proposes the removal of a portion of the *acromion* and coracoid process, together with the whole glenoid cavity, because they hinder the quick union of the parts by the adhesive inflammation (1).

Supported by the law of the formation of the bone, in consequence of which the top of the *acromion* remains cartilaginous to the age of from eleven to fifteen years, **Lisfranc** (*e*) recommends, for persons of this age, the following practice :—Be the position of the arm what it may, the operator places the heel of the amputating knife upon the outer side of the top of the coracoid process, and carries it up to the hind edge of the arm-pit. The flap thus formed is lifted up, the cartilage of the *acromion* and collar-bone cut into, the joint readily entered, and the under flap formed in the usual way.

When the upper-arm-bone has been shot through by a ball close under its head, the appearance of the wound does not point out its importance, as the shoulder retains its form; and it can only be ascertained, when the arm-bone is examined throughout its whole length with the fingers, when a deep pit is found, which points out the solution of continuity. Enlargement of the shot wound is insufficient for the removal of the head of the bone, and if it be left it causes inflammation, suppuration, and destruction of the bone, which render the exarticulation of the arm necessary. In such cases these symptoms must be guarded against, by the early removal of the head of the bone, or of the broken pieces. **Larrey** (*f*) made a cut in the middle of the deltoid muscle, parallel to its fibres, carried it down as far as possible, divided the edges of the wound on the sides, so that he laid bare the joint of which the capsular ligament is generally opened. With a curved, blunt-pointed bistoury the insertions of the *m. supra-spinatus*, *infra-spinatus*, *teres minor*, *subscapularis*, and the long head of the *m. biceps* were divided, the head of the bone freed and removed with the fingers. The arm was then brought up to the shoulder, and kept in that position by proper bandages and a sling. Either *anchylosis* between the arm and shoulder-blade, or an artificial joint, which permits certain motions, is the result.

Guthrie (*g*) says that "a wound from a musket-ball, causing a fracture beneath and exterior to the capsular ligament, although in its immediate vicinity, by no means demands amputation, from this cause alone. With a wound from a musket-ball passing through the soft parts and the bone, in the same situation, without destroying its substance to any great extent, the arm has frequently been preserved."

(*a*) Above cited, p. 504.

(*b*) **Faur**; in Mémoires de l'Académie de Chirurgie, vol. ii. p. 463.

(*c*) New England Journal, vol. iii. Boston, 1814.

(*d*) Above cited.

(*e*) **Averill**, above cited, p. 130. Edit. of 1823.

(*f*) Mémoires de Chirurgie Militaire, vol. ii. p. 173.

(*g*) Above cited, p. 424.

[(1) Unless disease of the *acromion*, glenoid cavity, or coracoid process, imperatively require their removal, when amputation at the shoulder-joint is performed, or when by accident the skin is not of sufficient length to cover the joint, the proposal of removing these processes, or either of them, is not to be entertained; no real advantage is to be gained from it; and if it be believed, that the continuance of the cartilage upon the glenoid cavity offer any bar to union in the ordinary time, which, so far as my own personal experience, and the observations I have made in the practice of others, is certainly not proved, the Surgeon may scrape off the cartilage, if he have a fancy to do so, but it is matter of no consequence at all.

Amputations at the shoulder-joint are not very frequently needed, as it appears from LISTON's reported cases, he had but one in University College Hospital during five years, and myself only one in six years at St. Thomas's, both secondary to accident, and both recovered. ASTLEY COOPER says:—"In every instance in which I have performed the amputation through this joint, and every case in which I have seen it done, the recovery of the patient has been speedy and perfect." (p. 432.)]

Amputation through Shoulder-Joint.

	Accident or Disease.	Operated on	Remarks.	Discharged.
1840 John Bateman, aged 39 (coal-carman), admitted July 25.	Compound fracture, with comminution and small wound in skin, but not much bruising; consequent on cart-wheel passing upon, but not over the arm. On the *fourth day* irritative fever set in; the whole arm much swollen. On the *sixth day* some bloody oozing, which continued through the day, and reduced him much. Bleeding came on again on morning of *twelfth day*, to the amount of six ounces; said to have been in a jet, but seemed to me to be venous; but it brought him very low. Was easily checked by pressure; and when he was revived by stimulants, the operation was performed.	Aug. 6. Twelve days after.	*With flap of m. deltoides* by piercing from before. The artery held as the second cut was being made. Six arteries tied, and *three hours* after two more. The flap was dropped down, and covered with a wet cold cloth. He became very restless soon after the operation, and so continued for *nine hours*, till the opium given sent him to sleep. At *twenty-two hours* the flap was lightly applied with straps of plaster. Went on very steadily improving; but the discharge from the wound was very profuse.	Nov. 10.

VII.—OF EXARTICULATION OF THE FORE-ARM AT THE ELBOW.

(*Exarticulatio Antebrachii*, Lat.; *Ablösung des Vorderarmes im Ellenbogengelenke*, Germ.; *Désarticulation de l'Avant Bras*, Fr.)

BRASDOR, above cited.

MOUBLET; in Journal de Médecine, vol. xi. p. 240.

MANN; in New York Medical Repository, vol. vii. 1821.

TEXTOR; in Neuer Chiron, vol. i. part i.

DUPUYTREN; in SABATIER Médecine Opératoire, vol. iv. p. 524. New Edition.

RODGER; in New York Medical and Physical Journal, vol. vii. p. 85.

2812. This operation, first performed by PARÉ, and more fully determined by BRASDOR, is objected to by nearly all writers, and amputation through the lower third of the fore-arm is preferred to it. MANN, TEXTOR, DUPUYTREN, and others have, however, performed it successfully.

2813. The operation is best performed according to TEXTOR's directions:—After making provision against the bleeding during the operation, and the arm being straightened, a long double-edged amputating-knife is passed in at the top of the outer condyle of the upper-arm-bone, carried flat before the bend of the elbow, and thrust through before and above the inner condyle, at corresponding height to the point of entrance, and then being drawn down, a flap is formed of three or four fingers' breadth long. The vessels found in this flap may be at once tied. A cut through the skin is next made on the opposite side of the arm, two fingers' breadth below the entrance of the former, extending from one end of the existing wound to the other, and the skin is dissected back to set the *olechranon* free. The external ligament is now cut through, the knife, carried between the upper-arm-bone and the *radius*, and the fore-arm being bent, cuts through the tendon of the *m. triceps*, and lastly, the internal lateral ligament.

According to **Brasdor**, a transverse cut should be made through the skin and tendon of the *m. triceps* on the extending side of the arm; the ligaments are then divided, and the whole knife, the arm being bent, is carried through the joint, and forms from the inside of the arm a fleshy flap.

Jaeger favours this method. The fore-arm being bent at a right or an oblique angle, he makes a semicircular cut through the skin with a small convex amputating-knife, two fingers' breadth below the point of the *olechranon*, from the head of the *radius* to the outer edge of the *ulna*. The skin is drawn back by an assistant above the *olechranon*, and the tendon of the *m. triceps* cut through, by which the joint is opened. Whilst the fore-arm is bent still more, the lateral ligaments between the upper-arm-bone and the *olechranon* and the *ulna* and *radius* are opened, the knife is carried over the coronoid process upon the front of both bones, the arm being slightly bent, and by cutting from within outwards, a flap of three fingers' breadth is formed, which the assistant grasps before its complete division, and compresses the brachial artery.

Hager makes two longitudinal cuts of three inches length, down from the condyles to the *ulna* and *radius*, by which he marks out the front flap. An inch below the upper angle he makes a semicircular cut through the skin and muscles behind, separates the little flap upwards, passes into the joint from behind, and forms the front flap, two inches or two inches and a half long.

Rodger forms the front flap with a semicircular cut, from the head of the *radius* to the inner condyle, and by separating the skin he forms the hind flap. After which the joint is cut through.

Dupuytren's (*a*) agreed with **Textor**'s method, except that he sawed off the *olechranon*. He performed this operation eight or ten times successfully, and preferred it as giving a greater length of the upper-arm, and leaving the *m. triceps* attached, by sawing off the *olechranon*. When the soft parts are not sufficient to form a front flap, **Dupuytren** made a circular cut through the skin and *aponeurosis*, the fore-arm being half bent, three fingers' breadth below the condyles of the upper-arm-bone. These parts are drawn back by an assistant, and the muscles cut through at their edge down to the bone. Whilst the operator separates them upwards from the bones, he reaches the joint, which is opened by dividing the lateral ligaments and the capsular ligament on the front. The knife then easily passes between the bones and the operation is completed.

Velpeau and **Cornuau** proceed in like manner with the circular cut, only they do not saw through but exarticulate the *olechranon*.

Textor (*b*) proposes the oval cut, which, however, is more difficult and not so advantageous as the flap, in the following way. The arm being brought horizontal, the fore-arm straightened, and the hand prone, the Surgeon standing on the outer side makes, with a small amputating knife, one cut about four inches long and penetrating to the bone, from the head of the *radius* obliquely upwards and inwards to above the tip of the *olechranon*, and then a second on the ulnar side from the upper end of the *ulna*, to the same height. He then dissects back the flaps to their base, passes between the upper-arm bone and *radius*, upon and around the *olechranon*, and cuts through the tendon of the *m. triceps*, whilst the fore-arm is bent and supine. He now cuts forwards and downwards over the coronoid process of the *ulna*, above the head of the *radius* and along both bones so far upwards as necessary to form a flap three fingers' breadth long. The wound is brought together lengthways.

Baudens proceeds in another way. The fore-arm being rendered supine and the brachial artery compressed, the Surgeon, standing on the inner side if he operate on the

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(*a*) Leçons Orales, vol. iii. p. 318.

(*b*) Jaeger, above cited, p. 365.

left, and on the outer if upon the right arm, marks with varnish an oval, which begins on the outer edge of the *radius* four fingers' breadth below the bend of the elbow, and terminates on the hind edge of the *ulna* three fingers' breadth below the bend of the arm. Following this mark he cuts through the skin, which, by dividing its connexions and drawing back with his left hand, he separates to the extent of eighteen lines. He then cuts through the muscles down to the bone, holds back the fleshy parts like a ball and divides the deep muscles circularly, at the same time passing between the joint surfaces of the upper-arm-bone and *radius*, and completes the exarticulation by division of the ligaments, and of the tendon of the *m. triceps* near the tip of the *olechranon*. The soft parts by their own weight drop over the joint surfaces and form a hollow globe in the point of which the joint surface of the *humerus* is found. After tying the vessels the wound is brought together lengthways.

VIII.—OF EXARTICULATION OF THE HAND AT THE WRIST.

(*Exarticulatio Manûs*, Lat.; *Ablösung der Hand*, Germ.; *Désarticulation du Poignet*, Fr.)

2814. The brachial artery is to be compressed with the tourniquet; one assistant holds the fore-arm and draws the skin back, a second holds the hand. The operator, standing on the inner side for the left, and on the outer for the right hand, makes a circular cut through the skin half an inch from the spinous process of the *radius*. The skin is next dissected up, without the tendons, to the wrist, turned inside out, and held by the assistant. The hand is now put between pronation and supination, the knife placed before the spinous process of the *radius*, and whilst the hand is pressed down, the whole knife is carried into the joint, obliquely towards the *ulna*, and divides all the ligaments and tendons. The edges of the wound, after tying the vessels, are brought together in the oblong direction of the joint.

Instead of the semicircular cut, a flap may be made upon the back and front of the wrist. It may be necessary on account of some peculiar kind of accident which affects the exarticulation to form a large upper or under flap; for this purpose the skin of the thumb and the like may be saved.

The above-described mode of proceeding is better than by dividing the skin and tendons on the back of the hand by a semicircular cut to pass into the joint, and drawing down the knife to form a flap on the front of the hand. Or, according to LISFRANC, the hand being held between pronation and supination, a narrow knife is thrust through the soft parts opposite the joint on the palmar surface from one side to the other, and then being drawn down forms a flap; after which a semicircular cut is made through the skin upon the dorsal surface, the flap turned back and the joint divided from the *radius*.

[If amputation through the wrist-joint be performed with flaps, special care must be taken to avoid, in forming the front flap, the pisiform bone, which often catches the knife, and unless well cleared, spoils the edge of the skin-cut.—J. F. S.]

IX.—OF EXARTICULATION OF THE METACARPAL BONES AT THEIR JUNCTION WITH THE CARPUS.

(*Exarticulatio inter Carpum et Metacarpum*, Lat.; *Ablösung der Mittelhandknochen aus ihren Gelenken mit der Handwurzel*, Germ.; *Désarticulation des Métacarpiens*, Fr.)

2815. The exarticulation of the metacarpal bone of the thumb, of the fore and of the little finger, and of all the four fingers together, the thumb being still preserved, is now to be considered. The exarticulation of the middle and ring metacarpal bones is not to be recommended. The disease being rarely confined to any one of these bones, the operation is attended with much difficulty. Collections of pus take place in the carpal joints, and the exarticulation of the hand afterwards becomes necessary, as I have seen in two cases. It is better therefore under such circumstances, to amputate through the continuity of the metacarpal bones of the middle and ring fingers.

2816. In *exarticulating the metacarpal bone of the thumb*, if the soft parts permit the formation of a side flap, it must be thus performed. An assistant, who holds the fore-arm, compresses the radial and ulnar arteries. The operator holding the thumb with one hand abducts it strongly, so as to render the fold of skin between it and the forefinger tense. He now carries a straight bistoury in this fold to the connexion of the first *phalanx* of the thumb with its metacarpal bone, and along the side of the metacarpal bone to the joint. The thumb is now violently abducted to stretch the ligaments, the whole knife carried into the joint, the metacarpal bone dislocated, the knife carried up on the other side of the bone, and along it, to its junction with the first *phalanx*, where, by cutting obliquely out, the flap is formed, which corresponds precisely to the first cut. After tying the vessels the flap is properly applied and fastened with strips of sticking plaster, and a bandage.

Where the formation of a side flap is not possible, and only an upper or under flap can be formed, the same mode must be employed as described in exarticulation of the metatarsal bone of the great toe.

2817. In precisely the same way may the metacarpal bones of the ring and little fingers be separated from their connexion with the *carpus*, only that these exarticulations are more difficult than that of the thumb.

2818. Langenbeck's method of shelling out the bone from the soft parts by carrying forwards a $\underset{\smile}{\wedge}$ shaped cut from the junction of the metacarpal bone of the thumb with the *trapezium*, and then cutting through the joint, is more troublesome and tedious than that described.

Scoutetten (*a*) has also applied his method to the metacarpal bone of the forefinger, of the ring and of the little finger, according to the rules given for exarticulation of the metatarsal bones.

2819 The oval cut of Scoutetten is most convenient for *exarticulation of the middle metacarpal bone.* The knife is placed at the joint, above the bone at the crease of the finger in front, and carried round correspondently to the first *phalanx;* then placed on the other side in this cut, and carried back, and in the same direction as the first cut to its beginning. The soft parts are separated by short strokes from the bone to the joint, which is best entered on the under side. The wound is united by bringing the neighbouring metacarpal bones together. The practice of making two side cuts in the interspace united on the dorsal, and palmar surfaces by an oblique or Λ shaped cut, keeping close to the bone to be removed, and avoiding the extensor tendons of the next fingers is inconvenient. The extensor tendon of the finger to be removed is divided with the point of the knife, the metacarpal bone pressed down, and the connexions of the joint cut through.

If *both middle metacarpal bones are to be exarticulated*, the fore and little finger being well abducted, one cut between the bones is to be made close on the radial side of the middle finger, and another on the ulnar side of the ring-finger to the *carpus*. These two long cuts are then to be connected on the volar and dorsal surfaces by transverse cuts close down to the bone, the soft parts turned back and the joint cut through. After the bleeding is stanched the flaps are to be brought together (1). The exarticulation of the last two or three metacarpal bones may be performed in

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(*a*) Above cited, pl. iii. iv. v.

like manner; the cut between the bones being first made, and then a longitudinal cut along the ulnar side of the fifth metacarpal, both these connected by a transverse cut on the back of the hand nearer or farther from the *carpus*, the soft parts dissected back, the joint divided and the volar flap made (2).

(1) von Walther (*a*) proceeds in the same way in extirpation of the middle and ring-finger, together with removal of the hind part of the metacarpal bone of the forefinger. Astley Cooper (*b*) also operated successfully in the same way.

(2) Riadore, Guthrie, von Graefe, von Walther, and Jaeger have removed in this manner the last two, and Astley Cooper the outer three and the first metacarpal bone with the thumb, so that the forefinger alone remained, and served as a very useful hook. Larrey and Riadore removed the second, third, and fourth metacarpal bones, preserving the thumb; and Tyrrell took away successfully the fourth and fifth metacarpal bones with the pisiform and unciform bones, and the half of the first, second, and third metacarpal bones. Benaben (*c*) extirpated, instead of the whole hand, the first and second metacarpal bones, the scaphoid, great, and trapezial bones, and cut off the upper part of the third metacarpal bone, preserving the outer three fingers.

2820. In *exarticulation of the four metacarpal bones*, but preserving the thumb, a double-edged knife is passed in, whilst the hand is supine, on the ulnar side, at the junction of the metacarpal bone of the little finger, thrust between the other metacarpal bones and the soft parts of the palm to the junction of the metacarpal bone of the forefinger, where it is thrust out, whilst the thumb is abducted. By cutting obliquely outwards a flap is formed; then a semicircular cut is made on the back of the hand, through the skin and tendons, and the joints opened on the palmar surface of the hand. After tying the vessels, the flap is brought over the wound and fastened (*d*).

Troccon (*e*) makes first the cut on the back of the hand, cuts through the joint, beginning on the radial or ulnar side, and forms a palmar flap, whilst the knife is carried into the opened joint and drawn forwards and downwards.

When the disease is confined to merely one or other metacarpal or metatarsal bone, it is very advantageous, according to Blandin (*f*), to remove that one alone, and to preserve all the others; with which opinion Jaeger also agrees.

In removing the first metacarpal bone, the hand is placed on its ulnar edge upon a table, and held firmly by an assistant, who grasps on the one side the thumb, and on the other the four fingers. The operator makes, along the muscles of the thenar eminence, a cut four fingers' breadth long, which must extend a little beyond the carpal and finger-joint of the first metacarpal bone. The edges of the wound are drawn asunder, and the attachments of the *m. opponens pollicis* and of the first *m. interosseus* are cut through. During the latter act the knife rests close above the first metacarpal bone, so as not to wound the radial artery, which lies close to the second bone. The tendons of the flexor and extensor muscles of the thumb are drawn back, the tendon of the great *m. abductor pollicis* cut through at its insertion, and the carpo-metacarpal joint of the thumb divided from without inwards; after which the bone is lifted out with strong forceps, and separated from all the fibrous parts which connect the metacarpal bone to the undermost *phalanx*.

In removing the other bones the method is the same, with but little variation. In removing the second metacarpal bone, wounding the radial artery is unavoidable. As to the rest, the part of the inner transverse ligament of the *metacarpus*, corresponding to the *phalanx*, must be left, the joint must be opened from behind forwards, and when this is half done, and the bone half dislocated, the knife must be lifted up before the

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(*a*) Journal für Chirurgie und Augenheilkunde, vol. xiii. p. 352.

(*b*) Lectures on Surgery, by Tyrrell, vol. ii. p. 423.

(*c*) Revue Médicale. 1825; vol. i. p. 371. March.—Jaeger, above cited, p. 334.

(*d*) Maingault, above cited, pl. ii.—Chirurg. Kupfertaf., pl. lxxiii.—Gensoul; in Revue Médicale. 1827; vol. ii. p. 143.

(*e*) Nouvelle Méthode pour l'Amputation du Poignet, dans son Articulation carpo-metacarpienne. Bourg, 1826.

(*f*) Gazette Médicale de Paris, vol. ii. p. 152; 1831.

head of the metacarpal bone, for the purpose of cutting through the anterior ligament from above, so that it remains attached to the *phalanx*, together with the transverse metacarpal ligament with which it is connected.

In extirpating the first metatarsal bone, the foot must be so placed as to rest on its outer edge; the operator then thrusts a long narrow bistoury on the inner side of the *m. extensor longus pollicis*, so that its point may come out at the inside of the tendon of the *m. flexor pollicis*, and then cuts out a flap, the base of which corresponds to the hind joint of the metatarsal bone, and its tip to the front joint of that bone; the rest of the operation is performed as on the *metacarpus*.

X.—OF EXARTICULATION OF THE FINGERS, AT THEIR JUNCTION WITH THE METACARPAL BONES, AND AT THEIR OWN JOINTS.

(*Exarticulatio Digitorum Manûs*, Lat.; *Ablösung der Fingerglieder aus ihrer Verbindung mit den Mittelhandknochen, und unter sich*, Germ.; *Désarticulation des Doigts*, Fr.)

2821. All that has been said in regard to exarticulation of the toes from the metatarsal bones, applies to amputation of the fingers at their junction with the *metacarpus*.

In exarticulation of the middle and ring-fingers, Dupuytren (*a*) cuts off the head of the metacarpal bone obliquely with a saw. In younger persons, in whom ossification is incomplete, the head of the bone may, according to Lisfranc, be cut off with a knife.

Barthelemy (*b*) thinks that inflammation, gangrene, and suppuration occur after exarticulation of the fingers from the metacarpal bones, in consequence of the strangulation of the underlying cellular tissue by the palmar *aponeurosis*, and therefore proposes, after extirpating the finger, to separate the processes of the *aponeurosis*, which is easily done; and by which, whilst the tension of the *aponeurosis* is got rid of, these bad symptoms are more certainly prevented.

2822. In *exarticulation of the joints of the fingers* from each other, if the state of the parts permit, the following is the best mode of proceeding:—An assistant draws out the diseased finger from the healthy fingers, held in a state of pronation, and holds them firmly. The operator, with his left thumb and finger, grasps the diseased joint and bends it, whilst with the other hand he carries a straight narrow bistoury, holding it as in making a longitudinal cut, a line below the projection which is formed by the head of the upper *phalanx*, in a horizontal direction from the left to the right side, with a stroke into the joint. The lateral ligaments are then divided, the diseased *phalanx* pressed much downwards, the blade of the knife carried to the palmar surface, forwards, and close to the bone, where by cutting obliquely a flap is formed.

If two flaps have to be formed, a semilunar cut is to be made on the dorsal surface of the joint, the skin drawn back, the joint cut into, and the lower flap formed as in the former case. This mode of proceeding is, however, unsatisfactory, because the upper flap is very thin, its dissection painful, and after the cure the scar is in the middle, and thus most exposed to external violence.

Less suitable is Lisfranc's (*c*) method of forming the flap, by thrusting the knife through the palmar surface, cutting into the joint from above downwards, and through the skin on the dorsal surface.

For the purpose of producing, by adhesion of the tendon of the flexor muscle, the mobility of the first *phalanx*, after the removal of the second, Lisfranc (*d*) previously makes a longitudinal cut of half an inch on the palmar surface, which wounds the

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(*a*) Sabatier, above cited, p. 534

(*b*) Journal Universel des Sciences Médicales. 1829; p. 211.

(*c*) Mémoire sur un Nouveau Procédé pour l'Amputation dans les Articulations des Phalanges; in Revue Médicale. 1823; vol i. p. 233.

(*d*) Ibid., above cited, p. 226.

tendon, the wound heals by suppuration, and then the extirpation is performed. This practice is objectionable, because thereby inflammation of the sheath of the tendon may be set up; it is also unnecessary, because the tendon unites with the scar (*a*).

[I take the opportunity, in concluding the subject of amputation through the shaft or in the continuity of bone, and through the joint or in the contiguity of bone, to add Liston's cases to my own for the purpose of making a better average of the recoveries and deaths after the operation for amputation.

Of Liston's cases . .	52	Recoveries . .	45	Deaths . .	7
Of my own cases . .	54	„ . .	42	„ . .	12
	106		87		19—106

Making a per centage of 82.075 recoveries, and 17.925 deaths to the whole number of cases operated upon.

IMMEDIATE AMPUTATION.

The question of Immediate Amputation has been already discussed (*b*) in treating of compound fracture, and to this the reader will refer. From the reports of the amputations which I have given, it is proved, as I there stated, that primary amputation is more serious in its effect on the constitution, when performed on the lower than on the upper limbs, and more especially when the thigh is the part of the member subjected to that operation. If, however, a much-injured thigh be not at once removed, the patient almost invariably has a fearful struggle with irritative or with hectic fever, if he escape the former, but more commonly he has to pass through both, and dies in consequence of his powers being completely worn out. The Surgeon is therefore placed in a most difficult situation in determining whether he shall amputate the thigh, or through it at once. The danger to the patient is great if the operation be performed, as my reports prove; the danger is as great and the patient's sufferings severe, protracted, and without good result, if the operation be not performed, as I have witnessed again and again. On the whole, I am inclined to believe that primary amputation of or through the thigh, is to be preferred. But with regard to the leg, the danger is very much less, and in the several parts of the upper limbs, comparatively trivial, and, therefore, according to my experience, amputation in these cases should not be deferred.

John Hunter indeed thought differently, and preferred secondary amputation in case of accidents: and his opinion is too important to be passed by unnoticed. He says (*c*):—"If a man gets a very bad compound fracture in the leg, or has his leg taken off, either for this fracture, or in consequence of any other accident, he stands a much worse chance of recovery than one who has been accustomed to a local disease; even the man with the compound fracture will do much better, if his leg is not taken off till the first symptoms are over; or at least we may be certain that the symptoms arising from the amputation will not be nearly so great as those that arise at first from the fracture, or would have arisen from the immediate amputation. * * * For, first, I do not look upon full health as the best condition to resist disease: disease is a state of body which requires a medium. Health brooks disease ill, and full health is often above par: persons in full health are too often at the full stretch of action, and cannot bear an increase, especially when diseased; and, as I have before observed, it is a new impression on the constitution, and till it be in some degree accustomed to local disease, it is less able to bear such as is violent; besides the removal of a diseased part which the constitution has been accustomed to, and which is rather fretting the constitution, is adding less violence than the removal of a sound part in perfect harmony with the constitution." (p. 233.)

Notwithstanding Hunter's great authority, however, I must still agree with Astley Cooper (*d*), that "if it will be necessary to amputate in a few days after the accident, then the sooner it is done the better. * * * For if you amputate immediately, the constitution has but one shock to sustain, and in general rallies much better than when the amputation is delayed." (p. 680).—J. F. S.

Rutherford Alcock, in his very able Lectures (*e*), which I regret my limits have not permitted me to make use of; but which are of such deep interest and importance that I would recommend them for careful perusal, and specially to Army and Navy Sur-

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(*a*) Mémoires sur de nouvelles Méthodes pour pratiquer l'Amputation dans les Articulations du Metatarse et du Métacarpe avec les phalanges; in Revue Medicale. 1823; vol. i. p. 382.

(*b*) Vol. i. p. 518–23, *par.* 590, *note.*

(*c*) On Inflammation, &c.

(*d*) Lectures.

(*e*) Lectures on Amputation, and on the nature, progress, and terminations of the Injuries for which it is required; in Lancet. 1840-41; vol. i. and ii.

geons, as they are more particularly concerned with the cases which form the principal subject of his consideration, observes :—" That the injuries of civil life, and the amputations for them, especially those performed in the primary period, are followed by more unfavourable results than equally grave injuries occurring in the field. If we reflect for a moment upon the mode in which the two classes of injuries are inflicted, I think an adequate reason will suggest itself. A man employed in some agricultural or manufacturing occupation, if he becomes the subject of a grave injury, it must be under circumstances for which his mind is totally unprepared, under circumstances the most calculated to cause terror and a great shock, mental and physical. * * * In military life, the injuries inflicted are under very different circumstances; it is true, men but the moment before with sound limbs and in full health, fall with bones crushed and broken, with limbs torn from their bodies. But every man goes into action knowing his liability to such occurrences; he sees his comrades fall on every side; many he sees bear it almost gaily—the majority with good courage; he has known hundreds to whom the same lot has fallen, recover, and either return to their duty or pass the rest of their lives, not unhappily with a pension. He is excited at the moment; the onward rush, the shouts of the victors and the vanquished mingling with the roar of artillery, the flashing peals of musketry, all tend to make him reckless of any feeling but one of wild excitement or enthusiasm. * * * The immediate shock of the injury is often, therefore, trifling in some of the worst injuries." (pp. 850, 51, vol. ii.)]

FIFTH SECTION.—OF EXCISION OF THE JOINTS (*a*).

(*Excisio Articulorum*, Lat.; *Ausrottung der Gelenktheile der Knochen*, Germ.; *Resection des Extrémités Articulaires des Os*, Fr.)

WHITE, CHARLES, Cases in Surgery, &c., p. 1. London, 1770. 8vo.

SABATIER, Séances Publiques de l'Académie de Chirurgie, p. 73. Paris, 1799.

——— Mémoires de l'Institut National, vol. v. p. 366. 1805.

PARK, H., An Account of a New Method of treating Diseases of the Joints of the Knee and Elbow. London, 1733. 8vo.

MOREAU, Observations pratiques relatives à la Resection des Articulations affectées de Carie. (Diss. Inaug.) Paris, an XI. (1803.)

PARK, H., and MOREAU, Cases of the Excision of Carious Joints; with Observations by J. JEFFRAY. Glasgow, 1806.

CHAUSSIER; in Magasin Encyclopédique, cinquième année.

WACHTER, Dissert. de Articulis exstirpandis, inprimis de Genu exstirpato. Groning., 1810.

ROUX, De la Resection ou de Retranchement de portions d'Os Malades, soit dans les Articulations, soit hors des Articulations. Paris, 1812.

SYME, JAMES, On Excision of Joints; in Edinburgh Medical and Surgical Journal, vol. xxxi. p. 256. 1829.

———, A Treatise on the Excision of Diseased Joints. Edinburgh, 1831. 8vo.

CRAMPTON, PHILIP, On the Excision of Carious Joints; in Dublin Hospital Reports, vol. iv. p. 185. 1827.

JAEGER, M., Article *Decapitatio*; in RUST's Handbuch der Chirurgie, vol. v. p. 559.

———, Operatio Resectionis conspectu chronologico adumbrata. Erlang., 1832.

MEYER, G., Ueber Resection und Decapitation. Erlangen, 1829.

2823. Although PAULUS ÆGINETA and HEISTER had previously pointed to the extirpation of diseased joints, yet was it only first performed by FILKIN of Liverpool, on the knee-joint, in 1762, and the removal of the head of the shoulder-bone was undertaken by VIGAROUX, DAVID and C. WHITE (1), about the same time. The successful result which WHITE, and afterwards BENT (*b*) and ORRED (*c*), had of this

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(*a*) I have here slightly deviated from CHELIUS, distinguishing Excision from Resection, and placing them in two distinct sections; to which they seem to me as fully entitled as Exarticulation and Amputation, and for the same reasons.—J. F. S.

(*b*) Philosophical Transactions, vol. lxiv. p. 353. 1774.

(*c*) Same, vol. lxix. p. 6. 1779.

operation led to its further extension to other joints. PARK applied it to the knee- and proposed it for the elbow-joint. MOREAU, father and son, performed it on the latter, and at the ankle- and wrist-joint; WHITE, and afterwards MÜLDER (2), proposed it for the head of the thigh-bone; VON GRAEFE (a) undertook it at the jaw-joint, and DAVIE (b) on the collar-bone. It was subjected to the closest examination by SABATIER, PERCY (c), ROUX, MOREAU the son, LARREY (d), and GUTHRIE (e), and much valuable experience in reference to it has been published. But the many and favourable results obtained by the English and German Surgeons, SYME, TEXTOR, and JAEGER, have contributed to extend the employment of this practice and by their successful issue have contradicted many of the objections to it.

(1) WHITE (f) performed this operation in the year 1769. It had been previously done by VIGAROUX and DAVID (g), although their operations were only published at a later period.

(2) WACHTER (h), VERMANDOIS (j), KOHLER (k), CHAUSSIER (l), and more recently HEINE have performed experiments on animals which have supported the proposition.

2824. In regard to the fitness of this operation, and in comparing it with amputation, the following have been specially stated as objections; the *difficulty of its performance*, especially on large ginglymoid joints, the *danger of violent inflammation and wasting suppuration*, *the tediousness of the cure*, and, particularly, that after the removal of the joint-ends of the bones of the lower extremities in consequence of the shortening and stiffness of the limb which remains, it is only retained in a condition far worse than the use of an artificial limb after amputation, which is much less dangerous. According to the cases as yet published, many of these objections have lost their importance, and are contradicted by experience. It must, however, be admitted that the removal of the ends of bones is more difficult than amputation or exarticulation, yet the danger during and after the operation is not greater than in amputation, and the symptoms are not usually severe; the cure, indeed, is more tedious but accompanied with fewer inconveniences, (SYME, JAEGER,) and with the preservation of the limb the patient finds it generally in a very useful condition. As regards the removal of the joints of the upper extremities, these circumstances are no doubt of the greatest importance, and to a certain extent influence its preference to amputation, as the preservation of the arm, even with confined motion, is not to be compared with its artificial supply after amputation, and experience of the consequences of the removal of the joints of the upper limbs points to the most favourable results. This operation on the lower limbs cannot, however, be considered so advantageous; it is here manifestly more dangerous, the after-treatment more tedious and difficult, and the result as to the capability of using the preserved limb, in many instances, incomplete; so that only under peculiarly favourable circumstances should the removal of the joint-surfaces be here performed.

(a) Bericht über das Klinisch-chirurgisch Institut. 1821.

(b) COOPER, ASTLEY, Lectures on Surgery, by TYRRELL, vol. iii. p. 297.

(c) Eloge historique de M. SABATIER.

(d) Mémoires de Chirurgie Militaire, vol. ii. p. 171.

(e) Above cited, p. 470, p. 521.

(f) Philosophical Transactions, vol. lix. p. 39. 1769.

(g) DAVID (fils), Dissert. sur l'Inutilité de l'Amputation des Membres dans la plupart des Maladies de la contiguité des Os. Paris, an XI.

(h) Above cited.

(j) Journal de Médecine, Chirurgie, et Pharmacie, vol. lxvi. p. 200.

(k) Experimenta circa Regenerationem Ossium. Exp. 14, 15, 16, p. 84–98 Götting., 1786.

(l) Above cited.

These statements are founded on the cases hitherto published. Of **Jaeger**'s collection of fifty-three cases of excision at the shoulder-joint but two had an unfavourable result; of thirty-four at the elbow only four; and in three at the wrist all were successful. In regard to excision at the wrist it is remarkable that **Syme** (*a*), otherwise so warm an advocate for the operation, gives a most unfavourable opinion, that it is very difficult to perform, that relapses easily recur, and that it leaves a stiff and unusable limb. He, however, admits that these objections are supported only by theory, and that experience might, perhaps, show them to be of less importance. Of thirteen excisions of the knee-joint, upon careful observation six were perfectly successful, three imperfectly so, in reference to the capability of using the limb, and three were fatal; a proportion decidedly less favourable than in amputation, but not so bad that excision of the knee-joint should be unconditionally rejected. Upon this point **Syme** (*b*) observes, that excision must always be considered more dangerous than amputation when the patient is very weak or has been wasted by previous disease; but if he possess moderate powers, it is not to be supposed either from general circumstances or from the results of experience that excision is attended with greater danger than the removal of the limb. It must, however, be mentioned that a larger number of cases would give us a more decided opportunity of comparing excision of the knee-joint with amputation. In five cases of excision at the ankle-joint the result was successful, and in twenty-four cases where it was performed for compound dislocation but one patient died. **Syme** (*c*), however, says, that although excision of the ankle-joint has not the objections to it that that of the wrist has, it cannot be extolled as of any great use. It affords, indeed, a support for the body, and it may be questionable in how far the foot, after the excision, is better than an artificial apparatus. **Moreau**'s experience also shows that *anchylosis* generally occurs after the operation; and although, as he observes, the other joints of the foot become more movable, so as in some measure to make amends for this stiffness, there can still be no doubt that the foot loses much of its elasticity (*d*).

[Upon the excision of joints **Crampton** (*e*) observes:—" It is impossible not to be struck by the fact, that the constitutional disturbance succeeding to the excision of even so large an articulation as the knee-joint, bore no comparison in kind or in degree, with that which experience has proved to be the invariable attendant upon simple penetrating wounds of a joint, when union is not effected by the first intention. This difference in the symptoms may, I think, be referred to that well-known principle of the animal economy, which disposes the system generally to suffer in proportion as the injured part is possessed of a higher or lower degree of sensibility, and as the injury is more or less difficult of cure by the proper forces of the constitution. Now, although it be true that when in an healthy state the parts which enter into the composition of a joint are possessed of but a low degree of sensibility, still it is well known that when suffering under disease there are no parts in which inflammation is attended with more exquisite pain, or in which the actions which tend to recovery are more slowly or imperfectly performed. It is not surprising, therefore, that a penetrating wound of a large articulation should be succeeded by a train of the most painful and dangerous symptoms. By the total excision of the joint, however, all those parts, which when diseased, influence the constitution so unfavourably are removed from the system, and the injury is resolved into a case of clean incised wound, with a divided but not fractured or diseased bone at the bottom of it." (pp. 207, 208.)]

2825. All the cases in which excision of the ends of bones is to be preferred to amputation of the limb, may be thus considered:—

α *Caries* and *necrosis* of the joint-ends of tubular bones, which does not spread further.

β Crushing of one or several joint-ends, without further considerable splintering of the bone towards its body, without injury of the principal artery and nerves, and without great destruction of the soft parts.

γ When, under like circumstances, a musket-ball remains sticking in the spongy structure of a joint-end, and cannot be withdrawn.

δ When, in compound dislocation, a joint-end protrudes from the soft parts, and cannot be replaced.

(*a*) Above cited, p. 119.

(*b*) Above cited, p. 131.

(*c*) Above cited, p. 141.

(*d*) **Jaeger**, Wurdigung der Resectionen; in **Rust**'s Handbuch der Chirurgie, above cited.

(*e*) Above cited.

ε Degeneration of the whole joint, from *spina ventosa* or *osteosteatoma*, when the boundary of the joint is not decided.

ζ *Anchylosis vera*, when the limb is thereby rendered useless, or very considerably restricted.

η Old dislocations, with impossibility of using the limb.

The condition of the patient's powers deserves particular attention in considering the indications for excision. Much sunken condition of the patient is always to be held as a contraindication, and amputation is here preferable, as with the removal of the source of the wasting suppuration, a relatively increased quantity of blood remains in the body, upon which depends the frequently and so quickly favourable change in the general condition after amputation, whilst in excision, especially of the knee-joint, a greater call on the powers is necessary.

The state of the soft parts may contraindicate excision, if they be largely destroyed or changed by disease. According to Moreau, the degeneration of the soft parts depending alone on disease in the joint-end, should by no no means forbid the operation; fistulous openings, consequent on affections of the bone, generally heal after their removal; the damaged part of the skin might very possibly also be included in the cut necessary for the exposure of the end of the joint, but a greater degree of destruction of the soft parts must always be considered a contraindication.

2826. The operation of decapitation includes the following acts: — *The cut through the skin and muscles, and the exposure of the joint-ends; the cutting off the bone*, and *the union of the wound by proper dressing.*

2827. When the patient has been properly placed and held by assistants, a competent person must be intrusted with the compression of the principal artery, which is preferable to the tourniquet, as the bleeding is in general trifling, and by application of the tourniquet the great venous bleeding is rendered more serious.

The direction and extent of the cut depend on the condition of the joint and soft parts. A sufficient, but not very large cut must be made according to Jaeger (*a*), from the simplest to the most complicated form, in about the following scale. *First*, the simple longitudinal cut —; *second*, the + or |—| or ┼─┼ cut; *third*, the |/ cut; *fourth*, the ⊤ or ⊥ or ┼— cut; *fifth*, the L or 𝐋 shaped cut; *sixth*, the └─┘ cut; *seventh*, the └┘ or ⊐ cut; *eighth*, the ├─┤ cut; and *ninth*, the ⊂⊃ or elliptical cut.

For making these cuts, a pretty strong knife should be used; the flaps therewith made separated from the bone, turned back, and held with a blunt hook, or by the fingers of an assistant, the ligaments cut into and divided, the head of the bone dislocated, and separated from the soft parts to the extent of the disease, and the *periosteum* there cut through. If possible, the joint should be at once opened in making the cut through the skin, and the ligaments lifted up with the flaps, as thereby the whole operation is shortened, the pain diminished, and the cut has more positive direction. After the spouting vessels have been tied, a wooden or horn spatula, a plate of lead, or a strip of leather or of linen, should be passed between the soft parts and the bone, to separate them from each other, and then the edges of the wound are brought together with the assistant's fingers or with a blunt hook.

2828. Close upon the spot where the *periosteum* has been divided, the bone must be cut through with a moderate-sized saw, or if it be not very strong and hard, with the bone-nippers, and every splinter removed with a little saw, the nippers, or the file. The still spouting arteries must be

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(*a*) Rust's Handbuch der Chirurgie, above cited, p. 582.

tied, the thickened ligaments and capsule of the joint, together with all superfluous skin, removed, the whole wound cleared of blood, and carefully examined both with the finger and the eye to ascertain whether any thing hurtful remains, that it may be removed.

In determining the boundary of the diseased bone, not merely must the extent of the *caries* be considered, but also the extent to which it has been separated from the *periosteum*, for if that part be left, *caries* or *necrosis* is quickly set up on it. In such cases the cut must, therefore, be extended into the firmly-attached *periosteum*, and the bone must be sawn through there. If the *caries* run into the spongy end of the bone, a plate of bone of corresponding depth to the *caries* must be sawn off, in which case the application of the white hot cautery-iron, according to MOREAU, generally increases the *necrosis*, and delays the cure (JAEGER.) If the bone be diseased more extensively than was supposed, amputation is generally required; however, in regard to this, everything depends on whether a large piece of bone can be removed from each or from only one of the bones of a joint, as well also as on the condition of the joint; thus, for instance, at the shoulder, five or five and a half inches of the upper-arm-bone have been successfully removed.

Of the numerous instruments which have been recommended for removing the ends of bones (*a*), the most convenient and applicable for all cases are, the common large and small bow saw, the knife saw, HEY's saw of different sizes, JEFFRAY's, (AITKEN's,) B. HEINE's chain saw, the bone-shears and nippers, variously-formed chisels, which, although they jar both the bone and the neighbouring joint, and increase the pain, are often indispensable. Sometimes it may be convenient to divide the bone partially with the saw, and then to use the nippers, with which the piece of bone can be easily removed.

The trickling of the blood from the wound is commonly stopped by exposure to the air, or with cold water ; but if it come from a spongy and thickened tissue, this must be removed, and cold water or some other styptic must be applied. Bleeding from a bone, when it cannot be checked by pressure with a sponge dipped in cold water, requires pressure with German tinder, with lint dipped in spirit of wine, or with little balls of wax. Severe venous bleeding, if it do not cease after the removal of the tourniquet, and after repeated inspiration and expiration, requires the application of cold water, or some other styptic. If the principal trunk of the artery or vein be wounded, which can only be done by awkwardness or carelessness, it must be tied ; but, in general, amputation will be necessary.

2829. In applying the dressing, which, according to JAEGER, is best done after the patient has got to bed, the limb must be laid on a pillow covered with oiled cloth, the ends of the bones put into proper place, either touching or not, and the edges of the wound brought together with the interrupted suture. Only when the teguments are so very thin that they would be cut through by the pressure of the suture-threads, should compresses of lint be applied to support them (SYME.) The most depending part of the wound must be left open for the escape of the discharge. The wound must be covered with lint, the part carefully raised, and another oiled cloth with SCULTETUS's bandage, compresses, and lint, laid upon the pillow, the limb placed on it in the position most proper for its future use, the several parts of the dressing applied, and, if necessary, secured with a suitable splint. JAEGER's practice, however, of surrounding the limb with compresses dipped in cold water and simply laid on a pillow till suppuration come on, seems to be best, as at this time SCULTETUS's bandage can never be applied so firmly as to give hope of keeping the bones together.

SYME's assertion that, after putting the limb in proper position, to swathe it in a long roller affords the necessary support better than splints, or stiff pieces of tin or pasteboard, is manifestly incorrect.

2830. The after-treatment must be conducted according to the usual

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(*a*) JAEGER. above cited, p. 584.

rules for wounds and amputations. The traumatic reaction is, according to the concurrent testimony of most observers, not great, and requires, at first, besides keeping the patient quiet, strict diet, mucilaginous drinks, and the use of cold applications. If there be little reaction and a cold œdematous state of the parts, warm aromatic fomentations should be employed, and a more nourishing and exciting diet. When suppuration begins the cold applications must be given up, and the wound dressed with lint and sticking plaster and bound up with Scultetus's bandage, to check any unnecessary movement of the arm. On the fifth day, those stitches which are most stretched must be removed, and the others according to circumstances from the sixth to the ninth day. When the fever subsides, more nourishment must be allowed, and the patient, usually about the eighth day, will have returned to his ordinary diet and drink. The scarring, in general, goes on quickly, and only now and then does the wound remain open longer (*a*).

2831. Among the untoward circumstances which may occur during the after-treatment the following may be specially noticed, *after-bleeding*, *abscesses*, *fistulous passages*, and *ulceration of the scar*.

If after-bleeding come on soon after the operation, the dressing must be removed and the bleeding vessels tied. If there be trickling from the whole wound, cold applications and styptics must be used. During suppuration, if large bleeding come on, amputation will be necessary, as tying the great arterial trunk does away with the least hope of a favourable result.

Abscesses which are formed by extension of the inflammation, or by the burrowing of the discharge into the neighbourhood of the operation, require poultices and to be opened with the knife.

Fistulous passages depend either on the continued secretion of *synovia* from a still remaining portion of the joint-surface, or on sluggish granulations of the thickened callous tissue, or on some carious part remaining, or on superficial *necrosis* of the edges of the bone, and require the continued use of aromatic applications until, in the latter case, small splinters of bone be thrown off.

Necrosis after decapitation, according to Jaeger, rarely or never affects the medullary cavity. Any remaining carious part, if it do not heal after the above-mentioned treatment, requires a second excision, or if it spread, amputation.

2832. The mode of dressing the sawn-off ends of the bone requires particular attention in the after-treatment. In the upper extremity the formation of *callus* should never be the object. On the contrary, however, in the lower limbs, and specially at the knee-joint, everything must be directed towards its production, and attention paid to the motions it will have to perform, or that state of rest in which it is to remain. If no *callus* form, a tough fibrous tissue which grows and connects the ends of the bones affords the limb sufficient firmness. If no firm union take place, if the limb be thereby rendered useless and not fixable by a firm enclosing bandage, it must be amputated.

(*a*) Jaeger, above cited, p. 394.

I.—OF EXCISION AT THE SHOULDER-JOINT.

(*Excisio Scapulo-humeralis*, Lat.; *Ausrottung im Schultergelenke*, Germ.; *Resection Scapulo-humérale*, Fr.)

2833. The most important proceeding in *excision of the head of the upper-arm-bone* is to form an upper flap, as in La Faye's exarticulation, (*par.* 2810,) to divide the connexions of the joint, to lift out the head of the arm-bone, and whilst a wooden spatula is passed beneath it for the protection of the soft parts, to saw it off. When the bleeding vessels have been tied, the sawn surface of the bone must be brought near the lower edge of the glenoid cavity, the flap laid down and fixed with sutures and strips of plaster, covered with lint and compresses, and the arm kept in proper position, by means of such bandages as Desault has described for fractured collar-bone. The after-treatment must be conducted in the same way as that of amputation, and bagging of pus must be especially prevented.

C. White, Orred and others, operated with a longitudinal cut from the socket of the shoulder-joint down to the insertion of the *m. deltoides*, and then having divided the tendon of the long head of the *m. biceps*, lifted out the head of the bone and sawed it off. This method seems most preferable in all cases where only fragments of the crushed head are to be removed. In chronic affections of the joint it must be presumed that dislocation of the head of the bone is easy under particular circumstances, that the ligaments are not very thick, and the like.

Bent formed a flap from the outside of the joint by one vertical and two horizontal cuts, running outwards from it. Sabatier made a V flap from the deltoid muscle.

Moreau thrusts in a scalpel, at the most prominent part of the coracoid process, to the bone, and cuts the skin and deltoid muscle directly downwards to the length of three inches; next makes another cut parallel to it, beginning from the back part of the lower edge of the *acromion*, then connects both with a transverse cut across the *acromion*, separates the flap and turns it down. The tendons and capsular ligament are now divided, the head of the bone lifted out, a long pad introduced between it and the soft parts, and then the head is sawn off. If the *caries* affect the glenoid cavity and the *acromion*, Moreau lengthens the front cut over the outer end of the collar-bone and the hind one to the spine of the blade-bone; separates this new flap, removes the carious part with the bone-shears or the chisel, and then fixes the upper to the under flap. Especial care must be taken that as much as possible of the capsular ligament should be cut off to prevent inflammation and profuse suppuration.

Syme makes a vertical cut from the *acromion* through the middle of the deltoid muscle, nearly to its attachment, then a shorter one from the lower edge of the former upwards and backwards, so that the outer part of the muscle is cut through. After this flap has been dissected up, the joint comes in sight, and when the capsular ligament, if existing, has been divided, the Surgeon passes his finger around the head of the bone, so that he may feel the attachments of the *m. supra-spinatus*, *infra-spinatus*, and *subscapularis*, which he easily cuts through by turning the knife first towards one and then to the other side. The movements of the arm should be prevented, to guard against irritation and displacement, and the latter by putting a pad in the armpit.

2834. After this operation the motion of the arm may remain under various circumstances:—*first*, the upper end of the remaining part of the upper-arm-bone may be drawn back to the glenoid cavity; *second*, it may be drawn from the outer edge of the blade-bone to the trunk; or, *third*, separated from it, may remain isolated in the soft parts. In the first case, a new perfectly free joint takes the place of the old one; in the second, an imperfect joint is formed without much motion; and in the third, the lever of the arm remains without any fulcrum, which, however, does not offer any obstacle to the direction and freedom of the movements preserved (*a*).

(*a*) Moreau, above cited, p. 31.—Textor, Ueber das Absägen des oberen Endes des Humerus; in Neue Chiron, vol. i. part iii.

II.—OF EXCISION OF THE ELBOW-JOINT.

(*Excisio Humero-cubitalis,* Lat.; *Ausrottung im Ellenbogengelenke,* Germ.; *Resection Humero-cubitale,* Fr.)

2835. Moreau's (*a*) method of *sawing off the elbow-joint* is as follows; The patient lies on a table covered with a mattress, upon his belly, so that the ailing arm may be put at a right angle with the trunk, at the edge of the table, in the strongest light, and the hind part of the half-bent elbow may be opposite to the operator. One assistant holds the upper and another the lower end of the limb, and the brachial artery is compressed with a tourniquet in the upper third of its course. A cut of three inches length is now made, with a single-edged scalpel, on each side of the lower end of the upper-arm, to the pit of the condyle, and both are connected by cutting through the skin and tendon of the *m. triceps;* the flap is now dissected upwards from the bone and held by an assistant. The fibres of the *m. brachialis internus* are next separated on the inner and outer side, from the bone, and an ivory spatula-shaped retractor passed between it and the soft parts. The elbow is held fast with the left hand, and that part of the upper-arm-bone to be removed is sawn off with a large saw by the right hand. The fore-arm is then dropped, the upper end of the sawn-off piece of bone lifted up, the knife carried in front of it, its connexions separated, and as it is set free, it must be decided how it can be removed without violence. If both *ulna* and *radius*, at their connexion with the upper-arm-bone, be deeply affected with *caries*, the fore-arm must be lifted up, a cut, an inch and a half long, made on the outer edge of the upper end of the *radius*, and a like one on the hind edge of the *ulna.* The flap between the two cuts is now separated downwards, the head of the *radius* freed from its connexions, a fold of linen, in place of a retractor, passed between it and the soft parts, and the diseased part cut off with a small saw, in such a way as to preserve the insertion of the *m. biceps.* In like manner the upper end of the *ulna* is laid bare, protruded by raising the fore-arm, the carious part sawn off, endeavouring to keep the whole or part of the insertion of the *m. brachialis internus.*

After tying the vessels and cleansing the wound, the two flaps are brought into place and fixed with five sutures, the wound covered with lint and compresses, and a Scultetus's bandage. The arm is to be laid half bent upon a pillow.

Dupuytren (*b*) forms, like Moreau, two flaps on the hind part of the joint, then draws out the *olechranon* so that the ends of the bone may be better protruded.

Syme also first removes the *olechranon*, cuts through the lateral ligaments for the purpose of freeing the lower end of the upper-arm-bone and then cuts it off. He then takes hold of the head of the *radius* with the cutting forceps, and removes the remaining part of the sigmoid cavity. The reason he gives for not at once removing the whole piece of the *ulna* is, that if cut through below the attachment of the *m. brachialis internus*, its removal is very difficult.

According to Moreau, the ulnar nerve must be cut through, by which sensation and motion is partially destroyed. Dupuytren recommends saving this nerve, by dividing the fibrous sheath in which it is contained, and lifting the nerve with a spatula over the inner condyle, where it is to be held whilst the bone is sawn off. Crampton and Jaeger are of the same opinion. Syme also preserves the nerve, which lies close to the inner edge of the *olechranon*, and will certainly be cut through if the transverse cut be made beyond the *olechranon* towards the inner condyle. The *olechranon* must therefore be felt for and the knife thrust into the joint, with its back towards the inside, close along the upper surface of the *olechranon*, but a little nearer the radial side, and then cut transversely with a sawing movement, for the purpose of dividing completely the tough tendinous parts till the radial tuberosity is exposed.

(*a*) Above cited, p. 42.

(*b*) Sabatier, p. 451.

Jaeger, in the absence of fistulous passages, always lays bare the ulnar nerve: he ascertains its position by feeling on the inner condyle, and then carefully makes a cut two, or two and a half inches long, upon it, of which the middle is upon the condyle; then opens the sheath of the nerve, takes hold of and lifts it up with a blunt hook, separates it from the soft parts, lifts it over the inner condyle, and there has it held fast with a blunt hook. With the left hand he now grasps the fore-arm, and, by bending it towards the upper, renders the *m. triceps* tense, cuts through it with a strong scalpel, a quarter of an inch above the *olechranon* from the inner to the outer condyle, and opens the joint, the bending of the arm being still increased, the lateral ligaments and skin upon the condyles are still farther cut through. The further progress of the operation depends on the extent of the *caries;* if but one condyle be affected on its joint surface or on its outer side, the longitudinal cut must be continued upwards to the extent of the *caries;* in *caries* of the whole cubital process, a longitudinal cut of an inch and a half or two inches length, must be carried from each side to the pit of the condyles, the flap dissected back to the part where the bone is to be sawn through, and the operation finished according to Moreau's method. If the cubital process be healthy, the lower longitudinal cut of from one and a half to two inches must be made from the inside of the *olechranon* and the outer part of the head of the *radius.* If the upper cut be already made, it must be continued downwards to the requisite extent, and the lower flap dissected from the *ulna.* If the *radius* be carious, a simple cut must be carried over its condyle to the extent of the *caries.*

After excision of the elbow-joint the *radius* and *ulna* always remain separate, although they are near together and held by the soft parts. The hand retains its power and mobility, and the fore-arm its most important motions. Every thing, however, depends on the circumstance, whether the insertion of the *m. biceps* to the *radius*, and of the *m. brachialis internus* to the *ulna* can be preserved. Jaeger's case, however, shows that motion of the fore-arm is possible, when even the insertion of the *m. biceps* has been destroyed.

[Crampton first performed this operation in Dublin, in February, 1823; but no account of it was published till 1827. Syme gave (*a*) an account in 1829 of three cases in which he had performed it.—J. F. S.]

III.—EXCISION OF THE WRIST-JOINT.

(*Excisio Radio-carpalis*, Lat.; *Ausrottung im Handgelenke*, Germ.; *Resection du Poignet*, Fr.)

2836. For the *excision of the lower part of the radius and ulna*, first performed by Orred and Moreau, Roux (*b*) gives the following directions. Two longitudinal cuts are made, one along the outer edge of the *radius* and the other along the inner edge of the *ulna*, as near as possible to its inner edge, to the wrist-joint, without injuring the vessels or nerves; a transverse cut is then made across the palmar and dorsal surfaces of the arm, avoiding the tendons. The lower end of the *radius* and *ulna* are then laid bare, sawn through, and the diseased carpal bones removed.

According to Jaeger (*c*), in *excision of the ulna* at the wrist-joint, the arm must be placed on its radial side, so that its ulnar side be before the operator, the hand bent in the opposite direction, the skin made tense with the left thumb and forefinger, and a cut begun upon the styloid process, and carried up two inches on the outer side of the *ulna.* From the lower end of this another cut is made, from three-quarters to an inch long, through the skin on the dorsal surface of the joint, the flap dissected off and the tendon of the *m. extensor carpi ulnaris* lifted up with a blunt hook. The *ulna* is now laid bare on the upper and under surface, the joint cut into above and on the side, whilst the hand is bent rather to the other side. The skin and tendons are then held back with a blunt hook, and either a small Hey's saw or a phalangeal saw applied at the upper sound part of the bone, which is then sawn through. The piece of

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(*a*) Edinburgh Medical and Surgical Journal, vol. xxxi. p. 256. 1829.

(*b*) Above cited, p. 54.

(*c*) Above cited, p. 678.

bone is now taken hold of with the forceps, drawn out and rolled downwards, and its inner connexion with the *radius* divided. The end of the *ulna* is then seized with a sharp double hook, drawn forwards, and its connexion with the *radius* at the joint divided.

In *excision of the radius*, the arm is placed on its ulnar side, a cut two inches long is made upon the inside of the lower part of the *radius* from above downwards to its styloid process, and from the lower angle of this wound a transverse cut, an inch and a half long, upon the dorsal side of the wrist. After the flap of skin has been dissected up, the sheath of the tendons is cut into, the tendons separated on both sides from the *radius*, and held by a blunt hook. The ligaments are made tense by bending the hand in the opposite direction, cut through from above and on the side, the *radius* dislocated, and as much of it sawn off with the phalangea saw as had been sawn off the *ulna*.

After cleansing the wound the fore-arm and hand are laid upon a pillow, the ends of the bones brought together, the longitudinal and transverse cuts united with sutures and the angles of both wounds left open. The joint is surrounded with oiled cloth and compresses dipped in cold water applied; when suppuration has set in Scultetus's bandage is to be put on.

Dubled makes a longitudinal cut on the ulnar side of the wrist, draws the edges of the wound asunder, divides the lateral ligaments, abducts the hand, isolates the end of the *ulna* and protrudes it as far as possible outwards, separates it from the *radius*, passes a wooden spatula between them, and saws through the bone above the diseased part.

The method laid down by Velpeau does not answer the purpose; it consists in connecting the longitudinal cuts on the side by a transverse cut on the back of the hand, and the flap being dissected back; in the soft parts being separated from the front of the bones, and in a plate of wood or lead being pushed through, upon which the *radius* and *ulna* are sawn through, and the connexions of the joint divided one after the other.

[Butt (*a*) of Portsmouth, Virginia, U. S., removed a large portion of necrosed *ulna*, sawing it through about four inches below the *olechranon*, and exarticulating it at the wrist. In three months the man was able to return to his trade as a carpenter, with flexion, extension, and rotation of the joint as uninterrupted as ever.]

IV.—OF EXCISION OF THE HIP-JOINT.

(*Excisio Coxæ*, Lat.; *Ausrottung im Hüftgelenke*, Germ.; *Resection Coxo-fémorale*, Fr.)

2837. *Excision of the head of the thigh-bone*, which in the seven cases hitherto published has had but one successful result, has been variously given in reference to the direction and nature of the cut.

First. By a simple longitudinal cut which, beginning an inch or two above the great *trochanter* descends three inches below it on the outer side of the thigh. After the division of all the tendons, the opening the capsule and division of the round ligament, the head of the thigh-bone is dislocated by turning the knee inwards, and then sawn off (White, Vermandois, Seutin, Oppenheim, and others). Roux holds a single vertical cut insufficient to lay bare properly the head of the thigh-bone, and suitable only in cases of destroyed ligaments and gun-shot wounds. Oppenheim (*b*) considers a simple cut as the best method, inasmuch as it is the most simple, is least injurious and heals most readily.

Second. By the formation of a flap, either as *α*. A ⊔ shaped flap on the outer side of the joint, according to the method of Percy and Roux; or *β*. A *triangular* flap, according to Jaeger's plan, by a longitudinal cut beginning from two to two and a half inches above the great *trochanter*, and descending three inches below it, so as to make in the whole a cut,

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(*a*) Philadelphia Journal, vol. i. p. 117. 1825.

(*b*) Hamburger Zeitschrift, vol. i. part ii.

from four and a half, to five and a half inches long, from the upper end of which a second cut of four inches is carried backwards and downwards. The triangular flap thus formed is dissected up, the insertion of the muscles at the upper and fore part of the *trochanter* cut through, the capsular ligament, and every spouting vessel tied, the head of the thigh-bone dislocated by turning the knee inwards, the round ligament cut through, a spatula passed under the neck of the thigh-bone, and that or the great *trochanter* sawn through with a small bow- or knife-saw. If the upper edge of the hip-socket be carious, it may be removed with Hey's saw, and the socket itself touched with the actual cautery. γ. A *semilunar* flap, according to Velpeau, in which the cut is carried from the front upper spine of the *ilium* to the ischial tuberosity, and a semilunar flap with its convexity downwards, is dissected up, and the back of the joint opened. Hewson's method of making a semilunar flap above the *trochanter*, and turning it downwards, is inefficient. And like it is Jaeger's semicircular cut carried round the great *trochanter* with its convexity upwards.

Third. By Textor's *oval cut;* he makes a cut beginning two inches above the great *trochanter*, carries it obliquely backwards and outwards, and ends it about an inch before the little *trochanter*. To this first cut follows a second, which, beginning on the front of the thigh opposite the point where the former ended, is carried obliquely outwards and upwards, and meets with it at a rather acute angle above the great *trochanter*. This second cut at first divides only the skin, but afterwards is continued down to the neck of the thigh-bone. The soft parts are then separated from the great *trochanter*, the capsular ligament cut into with a strong scalpel from within outwards, following always the edge of the hip-socket, over half its extent, down to the head of the thigh-bone, the knee being then bent inwards, the round ligament is divided with the scalpel, the head of the bone dislocated, fixed with the hand, and a knife carried round the part where the bone is to be divided, so that the track of the saw may be made easy and then the bone cut through with the osteotome, or with a small bow- or knife-saw.

When the operation has been finished, the vessels tied, and the wound cleansed, some sutures are put in at the upper part, and supported with straps of plaster, but the lower end is left open with a strip of linen in it, to favour the escape of the discharge. The wound is covered with lint and compresses, which are kept together with a cloth passed around. The feet may be tied together, or, if circumstances permit, Hagedorn's apparatus may be put on.

Of the seven cases, published, of excision of the neck of the thigh-bone, but one has terminated successfully. It is incorrect to include with these, those cases in which the head of the thigh-bone had been completely destroyed by *caries*, or had been removed necrosed, (Schmalz,) as well as the mere sawing through the neck of the bone in *anchylosis*, (Barton, Rogers.) A case of Kluge's (*a*) and one of Ohle's (*b*) are doubtful.

Anthony White (*c*) cut off the head of the thigh-bone in a boy of fourteen years, on account of very severe hip disease; four inches of the bone were removed, it formed a very useful artificial joint; the patient lived five years, and could use the bone perfectly well; it did not even appear much shortened. Carmichael (*d*) performed the operation on a young woman for medullary *sarcoma* of the thigh, but she died next day. Oppenheim (*e*) performed it on account of a crushing of the head and neck of the thigh-bone, and of the great *trochanter*, by a musket-ball; he sawed off the lower end of the

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(*a*) Wagner, Article *Decapitatio;* in Busch, von Graefe, Hufeland, and Rudolphi's Encyclopaedisches Wörterbuch, vol. ix. p. 188.

(*b*) Schmidt's Jahrbuch, vol. ii. part i. p. 116. 1834.

(*c*) London Medical Gazette, vol. ix. p. 852. 1832.

(*d*) Oppenheim's Zeitschrift, vol. i.

(*e*) Above cited.

fracture close to the little *trochanter*, enlarged the wound upwards, and after dividing the capsule and round ligament, he removed the three pieces of the head and also the bullet. The patient died eighteen days after. Hewson (*a*) performed this operation for *caries;* the bone was sawn off above the little *trochanter*. The patient died three months after, in consequence of the burrowing of a large quantity of pus, which passed by an opening in the hip-socket into the *pelvis*. Seutin (*b*), in a gun-shot wound which had split the neck of the thigh-bone to pieces, and injured the soft parts but little, made a cut from the crest of the hip-bone, to three inches above the great *trochanter*, adducted the limb, dipped into the bottom of the wound, and removed fifteen loose pieces of bone of various size and form; the lower fragment of the bone was lifted out of the wound and sawn off beneath the lowest split portion. The getting out the head of the bone, which was broken immediately in the cavity of the socket, was difficult; including the neck and head, six inches of the bone were removed. The contentive apparatus, and a half-bent posture on a double inclined plane, were employed. The patient died on the ninth day, of gangrene.

Textor (*c*) has operated three times. In the first case, on a child seven and a half years old, on account of fracture of the neck of the thigh-bone, and abscesses following; the head of the bone, and two inches from the great *trochanter*, above the little *trochanter*, were removed. In the second case, in a young man of eighteen, for *caries* of the head of the bone, the patient died on the fourth day. In the third case, in a man of fifty-four years, on account of *caries* of the great *trochanter*, and of the neck of the thigh-bone, six inches were removed, and the patient died on the fifty-third day.

The interesting results after removal of the head of the thigh-bone in brutes, in reference to the regeneration of bone, are given in Heine's (*d*) experiments.

[Charles White would seem to have been the proposer of excision of the head of the thigh-bone, although he did not perform the operation, for he observes (*e*):—" I have likewise in a dead subject, made an incision on the external side of the hip-joint, and continued it down below the great *trochanter*, when cutting through the bursal ligament, and bringing the knee inwards, the upper head of the *os femoris* hath been forced out of its socket, and easily sawn off; and I have no doubt but that this operation might be performed upon a living subject with every prospect of success. The Royal Academy of Surgery at Paris proposed for a prize question, whether amputation of the thigh at its articulation with the *os innominatum*, was ever advisable; but, was I under a necessity of performing this operation, or that which I have been describing, I should not hesitate a moment which to prefer." (p. 66.)

The first successful excision of the head of the thigh-bone was performed in Westminster Hospital by Anthony White, in April 1822, to which Chelius refers above, from the slight notice by Beale. It has since been fully published by S. Cooper (*f*), from notes furnished by White, who has also kindly given me the following more concise account.—J. F. S.

Case.—" *John West*, when nine years old, slipped down stairs and slightly hurt his left hip. After a few weeks, he was observed to limp in his gait, and complained of stiffness and pain in his groin; and subsequently he lost the power of locomotion, had the usual symptoms of disease in the hip-joint, and the head of the thigh-bone became displaced and rested far back on the *dorsum ilii*. He suffered very acutely, and underwent the usual treatment of cupping, blistering, with every other mode of local and constitutional treatment for many months, but without benefit, and after a time suppuration in the joint took place, which was evacuated from the front and upper part of the thigh. Temporary relief was thus obtained, but during two years a succession of similar abscesses formed around, and small portions of bone were frequently protruded through the sinuses which remained, and, more especially, from those formed over the *pubes*. At the end of the third year he was in the greatest possible state of emaciation, no longer suffering acute pain, but exhausted by the previous suffering and by an overwhelming discharge from numerous apertures. The integuments over the displaced bone had become at various parts absorbed, and the bone at these points was readily found to be in a state of superficial *caries*. The knee had been long imbedded and immovably fixed on the inner side of the opposite thigh, and the right side on which he could alone lie was cruelly galled with bedridden ulcerations. The formation of fresh abscesses had for some months ceased and further diseased processes were not apprehended. In the month of *April* it was determined, on consultation with Tra-

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(*a*) Oppenheim, above cited.

(*b*) Gazette Médicale de Paris, vol. i. p 135. 1833.

(*c*) Lepold, F., Ueber die Resection des Hüftgelenkes. Würzburg, 1834.—Oppenheimer, S., Ueber die Resection des Hüftgelenkes. Würzburg, 1840.

(*d*) Oppenheimer, above cited, p. 51.

(*e*) Cases above cited.

(*f*) Dictionary of Practical Surgery, p. 272. Edition of 1838.

VERS, to remove the head of the bone; the circumstances of his health, with the exception of great emaciation, not forbidding it.

Operation.—"An incision was first made through the integuments, beginning about an inch above the point where the head of the *femur* was deposited, and then carried down the centre of the bone to a point as far as was considered necessary for sawing through it. The integuments were then separated on each side, making their dissection as close to the bone as possible. The straight saw was then used and the *femur* divided without difficulty about two inches below the top of the great *trochanter* and including the little *trochanter*. So closely adherent was the upper portion of the bone to the *ilium*, that I was compelled to introduce a spatula between the sawn ends and used it as a lever, by which he was enabled to detach the subjacent parts, and to finish the operation. A very small quantity of blood was lost, and the boy suffered less than was anticipated. The bone had lost very little of its original form; the round ligament and the cartilage were gone, and the head of the bone was slightly affected with superficial *caries*. Several patches were also seen on other parts where absorption of the surface had taken place. Neither the finger nor probe could detect any morbid condition of the *ilium*, but the original site of the *acetabulum* was not to be found.

"The knee was now gently carried outwards, the removal of the fixed head of the *femur* now no longer acting as opposing that movement; and the divided end of the bone which had been exposed during the operation was thus brought deeply into the wound. After the dressing and application of bandages necessary to retain the parts in their new situation, and also to secure the limb in the straight line with the body, he was put to bed upon his back, and treated as for compound fracture. A slight attack of symptomatic fever ensued, which did not continue beyond a few days.

"The wound quickly healed; the various sinuses soon ceased to discharge, and the health of the patient speedily improved. Within twelve months he enjoyed a most useful compensation for the loss of the original joint; had perfect flexion and extension of the thigh, and every other motion except that of turning the knee outwards. The limb, of course, remained shorter, by as much as had been cut off from the top of the thigh-bone." He died five years after the operation, of *phthisis*, and an opportunity was thus obtained of ascertaining the condition of the parts.

Examination.—The thigh-bone had been sawn off a little below the less *trochanter*; the upper end of its shaft was largely covered with fibrous tissue and very loosely though firmly connected on the inner side with a mass of this structure which filled up the hind part of the hip-socket, so that the top of the shaft lay against but not at all supporting the upper lip of the socket, the front of which seemed filled with bone. It is probable that before the operation, as usual in cases of advanced disease of the hip-joint, the margin of the socket had become everted, and the whole socket shallowed. There was no appearance of synovial membrane, capsular ligament nor other part of a true joint. And the condition may be described as that of a soft *anchylosis* with the connecting medium so long as to admit of very free movement. The preparation is now in the Museum of the Royal College of Surgeons of England; and from careful examination of it, the account I have just given is drawn up.—J. F. S.

The second successful case is FERGUSSON's (*a*), who operated in March 1845, on a boy of fourteen years, who had been first attacked with hip disease thirteen months previous. "The head of the bone could be felt through the soft parts, lying on the *dorsum ilii*, and its identity could be more accurately ascertained by passing the finger into a large sinus, which opened on the surface, over and behind the *trochanter major*. The articular extremity was so isolated that the finger could be passed round it in all directions. * * * A longitudinal opening about six inches long, was made in the line of the *femur*, extending from over the head of the bone to a little below the *trochanter major*, and the tissues were separated from the shaft of the bone, so as to permit a curved needle to be used for the introduction of a chain-saw." This, however, broke, and "I was compelled to adopt another mode of procedure. With a sharp-pointed bistoury, I separated all the soft parts from the neck of the bone and the *trochanters*, and then, by causing the knee to be moved across the opposite thigh, and using the *femur* as a lever, the head and portion of the bone thus isolated, was so thrust out of the wound, that I could with facility apply the ordinary saw for the requisite section. Not being satisfied with the condition of the interior of the bone at the surface exposed by the saw, I enlarged the opening, and removed about three quarters of an inch more, then closed the wound with a few points of interrupted suture, and covered it loosely with a pledget of lint. No vessel of sufficient magnitude to require a ligature was divided. The cotyloid

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(*a*) Excision of the Upper end of the Femur, in an example of Morbus Coxarius; in Med.-Chir. Trans., vol. xxviii. 1845.

cavity was filled by a fibro-gelatinous mass, similar to the lining of the sinus. When the patient was put to bed, a long splint was applied, with a view to keeping up gentle extension. * * * There was scarcely any shock succeeding to the operation, and the chief complaint was pain in the knee, which for some days after, was more severe than at any previous period. * * * The length of bone removed was four inches and a quarter, measured through the curve of the neck and shaft, and the limb is now (after his recovery) two inches and a half shorter than its fellow. The cartilage was almost entirely removed from the head of the bone, and the surface was in a state of ulceration. The *trochanter* and rest of the shaft seemed in a healthy condition." (p. 572–76.) The operation was performed on the 1st of March, and on the 8th of May he was able to get up and move about on crutches. Some months after he was in good health, walked about on crutches, and had "free movement both at the knee and hip, and already at the latter part, has considerable power in elevating the thigh by the action of the *psoas* and *iliacus internus* muscles." (p. 579.)

V.—OF EXCISION OF THE KNEE-JOINT.

(*Excisio Genu*, Lat.; *Ausrottung im Kniegelenke*, Germ.; *Resection du Genou*, Fr.)

2838. In *excision of the knee-joint*, according to Moreau's method, after placing the patient on his back, and compressing the femoral artery with a tourniquet, two longitudinal cuts are to be made, one on each side of the knee, beginning from two inches above the condyles of the thigh-bone, and running down till they reach the shin-bone, where they are connected by a transverse cut below the knee-cap. This flap, together with the knee-cap, is turned up, and the latter, if diseased, removed. The knee is then bent, so that the exposed condyles protrude on the sides, the soft parts very carefully separated from the hind part of the bone, pressed backwards with the left forefinger, and the bone sawn off. If the joint-ends of the shin- and splint-bones must also be removed, a longitudinal cut is made upon the front edge of the shin-bone, and the already-made outer cut lengthened to the head of the splint-bone; the two flaps thus formed are now turned down, the head of the splint-bone removed with a small saw, and afterwards the head of the shin-bone cleared and sawn off. After the bleeding is stanched and the wound cleansed, the soft parts are brought together and covered with lint, compresses, and Scultetus's bandage. The whole limb is placed on a long chaff pillow, and kept in this posture with two well-padded splints, so as to prevent any movement of the limb, but without pressing on it.

Park made a longitudinal cut, beginning two inches above the knee-cap and ending two inches below it; then a transverse cut above it down to the thigh-bone, nearly in a half circle around the joint. He then removed the knee-cap, divided all the ligaments, and carried a narrow knife close above the condyles behind the thigh-bone, thrust in a spatula, sawed off the bone, and then protruded the head of the shin-bone forwards.

Mülder (*a*) proceeded in like manner; only, after having cut through the thigh-bone, he bent the leg, by which the condyles were protruded, and then he sawed off the upper part of the shin- and splint-bones, having passed a spatula behind them.

Sanson and Begin (*b*) recommend, after half bending the leg, to make a transverse cut from one lateral ligament to the other, and to divide them and the ligament of the knee-cap at a stroke. The joint-surfaces of the thigh- and shin-bone are then easily laid bare; and by continuing the cut, according to circumstances, along these bones, the joint-surface of one or other bone may be protruded and thus easily sawn off.

Jaeger proceeds in like manner, making upon a transverse cut nine inches long, which divides the ligament of the knee-cap and the lateral ligaments, two side cuts an inch long, of which each is distant about an inch from either end of the transverse cut -+-+-.

According to Syme (*c*), two semicircular cuts should be made across the fore part of

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(*a*) Wachter, above cited.

(*b*) Sabatier, above cited, p. 457.

(*c*) Above cited, p. 133.

the joint, extending from one lateral ligament to the other, meeting at their extremities, and including the knee-cap between them. Very free room will thus be afforded, which may be easily enlarged, if required, by cutting longitudinally at the point of union of the transverse incisions.

The transverse cut, according to JAEGER's method, has the advantage of at once affording a close insight into the seat and extent of the disease, and assists in the necessary variations of the operation. This proceeding is safer than MOREAU's, as the separation of the soft parts from the back of the thigh may be effected without the slightest danger, and the longitudinal cut may be rendered either unnecessary, or at least of but half the length formerly employed.

According to MOREAU, the cure does not take place by the union of the ends of the bones with *callus*, as PARK, and MOREAU, the father, supposed; however, in MÜLDER's case, even in twelve days after the operation, good *callus* had been formed; and, on cutting into it three months after, it was found well formed; only a partial destruction seemed to have taken place in it by the suppuration.

JAEGER is also of opinion that true bony union by *callus* follows very rarely, and that even in most of the successful cases, only a tough fibrous tissue, like the intervertebral substance, or the ligamentous bands in many fractures of the neck of the thigh-bone, is formed, but which does not in the least oppose the movements of the joint, as there is a restricted artificial joint and a sort of motion. He correctly seeks for the causes of the non-union, in the very extensive removal of the ends of the bones, in the undoubted destruction of union by improper dressing, and the early movement of the joint. The whole of the condyles, therefore, should not be removed, so that the thigh-bone may rest with a broad surface on the shin-bone; such an apparatus should be applied that the limb should very rarely be lifted up to be used, and the knee should be free. For the first four weeks the patient should observe the strictest quiet, the splints should only be removed after the complete closure of the fistulous passages; and the first attempt at rotating the thigh should not be made before the tenth or twelfth week, and raising the leg only after sixteen weeks.

SYME (*a*) believes that it is often very difficult after the operation to bring the limb exactly straight, on account of the contracted state of the flexor muscles, which prevent it being straightened, notwithstanding the relaxation, which arises from the shortening of the limb; that it is best to place the limb on a double-inclined plane, and in as good a position as is possible, with suitably-strong pasteboard splints. In some days the tension ceases, and the bone must again be put perfectly straight. During the cure no absolute rest of the limb is observed, for the purpose of preventing actual *anchylosis* or bony union, as the very long bone that would be thus formed, besides being very inconvenient, as the joint is stiff, would be also more exposed to the danger of being fractured, as it offers a long lever to any violence which may act upon the extremity. Great mobility would render the limb useless. The principal difficulty in the cure consists in preventing the tendency of the limb to bend outwards, as well, also, as in preventing too free motion.

[I cannot refrain from noticing here a case of compound dislocation of the thigh-bone behind the leg which occurred to ANTHONY WHITE some years since in Westminster Hospital, and for the following slight sketch of which, from memory, I am much indebted to him, as it is one of the most remarkable amongst the many instances of constitutional power, in young persons, with which I am acquainted.

Case.—Matthew Burgess, aged seven and a half years, whilst running behind a cabriolet on *August 2nd*, 1839, had his left leg caught in the wheel, which twisted and dislocated the condyles of the thigh-bone through a large transverse wound above the bend of the knee-joint, and extending a little in front of either hamstring. The twist was so violent, that the condyles were also forced through the leg of his duck trousers, where they lay, on his admission into the hospital in the morning. The trousers having been cut off and the parts examined, neither popliteal nerve, vein, nor artery were found in the pit between the condyles, and it was not certain that they had not been torn through. Attempts were made to replace the bone, but without success.

Looking at the child's age, WHITE was very averse to amputate the limb, and on consideration was determined to make an effort to save it. The boy was, therefore, left some hours that he might recover the immediate shock of the accident, and towards evening having cheered up, WHITE passed a broad plaster spatula between the front of the condyles and the skin of the calf of the leg upon which they lay, and without difficulty sawed them off. The sawn shaft immediately dropped into its place, and on passing the finger into the wound, which could not previously be done, it was with

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(*a*) Above cited, p. 134.

much pleasure that the popliteal artery was found pulsating. The limb was then placed on the side with the knee a little bent, the wound dressed, and some splints applied to keep it steady. Directions having been given to cut a hole through the bed, so that his motions might be passed without alteration of his position, this was made so large that in the course of the night he slipped right through, and was found on the floor. He was immediately replaced and the apparatus re-adjusted. I am not informed how he went on, but at the end of a twelvemonth, short of four days, he was considered well enough to leave the house, the wound being healed; but he could not bear upon his leg. Some months after a large abscess formed in front above the head of the shin-bone, and after the lapse of twenty months from the time of the accident, a large piece of bone about an inch thick exfoliated, and came away. From this time his amendment was permanent, and about five or six months after he became able to bear on his leg, and at last to walk, having a wooden pin, about four inches long, fixed on the sole of his shoe, which was firmly fastened to the back of his leg by a light iron shield fitted to it.

January 5, 1847.—I saw the boy, now fourteen years of age, a stout lad. The thigh- and shin-bone are firmly anchylosed by bone, in a slightly-bent posture. The scar is very distinct, and to the extent already described. The leg and foot are inclined a little outwards, so that the inner joint-surface of the head of the shin-bone juts forwards before the shaft of the thigh bone, and is rounded. The connexion of the two bones seems to be complete right across. The knee-cap is distinct, rather small, quite free from *anchylosis*, and capable of being moved a very little from side to side, but quite sufficiently to show that its natural condition is unchanged. Above the knee-cap is the scar by which the exfoliated bone came away. The calf-muscles are larger than usual, I think, for a boy of his age, which is rather remarkable, as the *m. gastrocnemius externus* must have been completely deprived of its principal upper attachments. —J. F. S.]

VI.—OF EXCISION OF THE ANKLE-JOINT.

(*Excisio Tali*, Lat.; *Ausrottung im Kniegelenke*, Germ.; *Resection du Pied*, Fr.)

2839. *Excision of the lower end of the shin- and splint-bones* was first performed by Moreau (*a*) in the following manner:—The patient being laid on his sound side, on a table covered with a mattress, the knee bent and the leg resting on the whole length of its inner surface, one assistant grasps it above, and another at the foot. The scalpel is thrust in perpendicularly upon the hind edge of the lower end of the splint-bone, the skin and cellular tissue cut through from above downwards, and the wound about three inches long, ends in a transverse cut, extending from beneath the outer ankle to the *m. peroneus tertius*. This flap is now separated from the surface of the splint-bone, turned up, and held upon the front of the leg. The *m. peroneus longus* and *brevis* are now separated from the part of the bone to be removed, which being cut off at the proper length with a sharp chisel, can be easily taken away. Through the same wound the lower end of the shin-bone is to be separated from all the soft parts attached to its outside. The patient is now to be turned round, the leg laid on its outer side, and a fresh flap made by one cut, three inches long, on the back and inner edge of the shin-bone, and another from the lower end of the former, running below the inner ankle to the *m. tibialis anticus*, and the flap then turned up. The fleshy parts attached to the back of the shin-bone are then separated to the height determined by the *caries*, so that the finger can be passed between them. The leg is then turned on its front, and carried so far from the other leg, that the operator can kneel down between its inner side and the edge of the table. A small narrow saw, with a blade six inches long, is now passed from within outwards, through the opening between the muscles and the bone, to the other side, then worked, and the handle sunk as it gets deeper in. After the sawing

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(*a*) Above cited, p. 91.—Roux, above cited, p. 53.

is completed, the divided piece of bone must be freed and removed through the inner wound; in doing which the tendons of the *m. tibialis posticus* and of the *m. flexor quartus digitorum longus* must be avoided. The chiseled end of the splint-bone must be made to correspond to the shin-bone. If the disease have attacked the *astragalus*, all that part of the bone which is affected must be carefully chiseled away, so as not to leave a cut surface, which will prevent the new connexion between it and the shin-bone.

After the wound has been cleansed and the bleeding stanched, each angle of the flaps is to be fastened with a suture, the knee half bent, the leg placed on its outer side, supported on a chaff pillow, and the wound covered with lint, compresses, and a Scultetus's bandage.

Jaeger (*a*) has modified Moreau's method in the following manner. The longitudinal cut of three inches is sufficient, but the transverse cut must be larger, about two inches and a half, as he now only meddles with the skin, and therefore passes over the tendon of the *m. peroneus tertius* without injuring it. The ⌊ shaped flap is dissected upwards, the external malleolar sheath opened, and both tendons and muscles dissected from the back of the splint-bone. The anterior, posterior and external ligaments of the splint-bone are then cut away from that bone, the joint opened, and next the ligaments between the splint- and shin-bones, cut through, and the splint-bone divided above the diseased part with a chain saw, or in want of this, nipped off with the sharp bone-nippers; the outer ankle is then grasped with the fingers of the left hand or with forceps, pulled up and completely separated from its hind connexions with the shin-bone; and whatever splinters remain must be taken away also. The joint-surfaces of the shin-bone and *astragalus* being now exposed, if they be found healthy the operation is concluded; but, if otherwise, the extirpation of the inner ankle must be proceeded with. For this purpose the longitudinal cut of three inches must be carried through the middle of the inner ankle, and the transverse one forward an inch and a half, it may also be lengthened backwards so that a ⊥ shaped cut may be formed. The flap is now, together with the *fascia*, to be dissected off close to the bone, the internal malleolar sheath opened, and all the parts on the back of the shin-bone, together with the nerves and vessels, carefully separated from the bone; and also on its front, the deltoid ligament cut through and the whole joint opened, in doing which the foot is again turned and the wound entered from the outside. After opening the joint, the inner ankle must be dislocated and brought out of the wound, by which the foot is turned at a right angle and rests on its sole. The shin-bone is then sawn off above the ankle with a small bow-saw. If the upper part of the *astragalus* be diseased, a small knife-saw may be passed into the wound, with which it may be sawn off, or what is better it may be removed with the file.

Throughout the whole of this operation no tendon need be wounded, and the front of the annular ligament not cut through, as otherwise the antagonism to the Achilles' tendon is taken away, and the operation is without satisfactory result (*b*).

Mülder (*c*) removed the *lower end of a carious splint-bone*, in doing which he first took off the fungous growth from the bone, then removed a portion of healthy bone together with the diseased part, enlarged the wound downwards with the scalpel below the ankle, separated it from the interosseous ligament, and through the capsular ligament and removed the lower part of the splint-bone. Kerst (*d*) also proceeded in nearly the same manner.

[Excision of the Ankle-Joint is most commonly employed in English practice, for compound dislocation, in which the shin- and splint-bones, both usually, broken from their malleolar processes, which still remain attached to the *astragalus*, are protruded through the skin wound, and either cannot be drawn back into their place, or if they can, are held to excite such irritation by the inflammation of their synovial covering, as to endanger the life of the patient, or at best to render the cure very tedious and exhausting. Under such circumstances, Astley Cooper strongly advised the protruded ends of the bones should be sawn off, and afterwards the shaft replaced. If the patient be young, there is generally little shortening of the limb even after the removal of half an inch or an inch of bone; and in the cases I have seen, *anchylosis* generally has not followed.—J. F. S.]

(*a*) Above cited, p. 688.

(*b*) Weber, B., Zwei Resectionen im Fussgelenke; in Friederich und Hesselbach's Beiträge zur Natur und Heilkunde, vol. ii. p. 142. 1827.

(*c*) Wachter, above cited.

(*d*) Heelkundige Mengelingen. Utrecht, 1835.—Hamburg. Zeitsch., vol. ii. part ii. p. 169.

2840. After decapitation of the splint-bone the wound is to be lightly filled with oiled lint, the flaps fastened with some sticking plaster, the wound covered with lint, and the foot laid upon its outside with the knee half-bent, upon a chaff pillow covered with lint and compresses, and the usual dressings.

After decapitation of both bones, their ends must be brought near to the heel, the longitudinal and transverse wounds brought together with sutures, the angle of the wound left open for the escape of the discharge, the wound covered with lint, and a bandage applied in the usual way.

According to MOREAU and BOYER, during the treatment the foot should be steadied by a foot-board attached to two side splints on the leg, to keep it immovable. This JAEGER thinks only of consequence if the shin-bone be left. In his case he dislocated both bones on the outside and placed them in SHARP's concave splints on SAUTER's swing, till he applied the common splints.

During the cure the ends of the bones approach each other, and become firmly united; in consequence of which, in many cases, when the *astragalus* is left entire motion is destroyed. This firm connexion is only first produced in the space of a year, from the use of the limb.

After the healing of the wound SHARP's splints must be applied. So long as the foot is not firm, the patient must walk with a crutch, till at last he can be fitted with a heel, corresponding with the length of the lost bone (JAEGER.)

VII.—OF EXCISION OF THE JOINTS OF THE METACARPUS AND METATARSUS.

(*Excisio Metacarpi et Metatarsi*, Lat.; *Ausrottung in den Gelenken der Mittelhand- und Mittelfussknochen*, Germ.; *Resection des Métacarpiens et des Metatarsiens*, Fr.)

2841. In the metacarpal and metatarsal bones, decapitation has the great advantage of preserving the joint. The *decapitation of the metacarpal and metatarsal bones* is performed with a longitudinal cut carried to the extent of the portion of bone to be removed, the sheath of the tendon covering it opened, laid aside, the muscles separated from the sides of the bone, and the joint opened from above. The chain saw is then introduced by means of a small semicircular needle, or a narrow finger-saw is passed beneath the bone which it divides, or it is cut off with LISTON's cutting forceps, or with the osteotome, lifted up, and whilst turned forwards or backwards, is completely separated from the soft parts.

After the wound has been cleansed, a connecting bandage is put on and cold applications made. To keep the bone in proper position, it is necessary to fasten a narrow pad, a foot long, on both sides, or upon the dorsal and plantar surface of the foremost *phalanx* with sticking plaster, and by drawing back equally the ends of the long pad the bones are kept together, and the ends of the pad are fastened upon the wrist or ankle-joint with plaster. On the foot, with a foot-board, a pad of lint and some straps of plaster are commonly used, passed over the end of the *phalanx*, and the ends brought over and fastened on the foot.

In old dislocations of the metacarpal bone of the thumb, decapitation is often indicated, and frequently performed. TEXTOR removed the end of the middle metacarpal bone and the *os magnum* in a case of *caries*. TEXTOR, KRAMER, and ROUX have also decapitated metatarsal bones; and FRICKE has obtained most successful results therefrom (*a*).

(*a*) GERNET, Ueber Resectionen; in Hamburg. Zeitsch., vol. iii. part iv.

VIII.—OF EXCISION OF THE LOWER JAW.

(*Excisio Maxillæ Inferioris*, Lat.; *Ausrottung des Unterkiefers*, Germ.; *Resection de la Machoire Inférieure*, Fr.)

2842. *Excision*, *Decapitation*, and even the *total Extirpation of the Lower Jaw*, may be indicated by various kinds of disease (1). *First*, On account of cancerous degeneration, which has extended from the lips to the bone, or when the cancer has arisen in the bone itself. *Second*, On account of *osteosteatoma*, *osteosarcoma*, *spina ventosa*, or fungoid degeneration of the jaw. *Third*, On account of deep-seated *caries*. *Fourth*, On account of *exostoses*, which cannot be removed at their base. And, *Fifth*, on account of want of union of fractures of the lower jaw. According to the difference of the seat and extent of the disease, excision of the middle part, the chin, or of the sides, with or without the removal of the processes at the same time, or even the extirpation of the whole lower jaw-bone, may be required.

That this operation should have a favourable result, the skin must be sound to such extent that it can properly cover the place of the removed part, and swelling of the neighbouring glands, or the signs of general cancerous dyscrasy must not in general forbid every operation. The hope of a favourable issue is greatest in sarcomatous degeneration of the jaw, but it is doubtful in all cancerous affections.

Only under the above-stated conditions of the skin and glands can cancerous degeneration be considered as indicating this operation; but they are very rare; and so far is Jaeger's (*a*) opinion correct, who, although the cases of Dupuytren, von Graefe, Fricke, and others favour undertaking this operation for cancer, considers that in general it is contraindicated. *Necrosis* of the lower-jaw, if unaccompanied with *caries*, must not be held to indicate the operation; for with proper treatment the dead piece of bone will be thrown off (2) or may be removed, for I have in several instances taken away more than half and in one case nearly the whole lower-jaw.

[(1) As will be presently seen, Deadrick was the first who, in 1810, cut away the side of the lower jaw; in 1812, Dupuytren sawed off a large portion of the front of the jaw; in 1816, Anthony White removed half a necrosed jaw from the socket; in 1818, Astley Cooper sawed of the projecting part of the chin; in 1821, Graefe removed the front of the jaw, and in the same year, one-half of the lower jaw, which he exarticulated, and the patient lived; Mott's first operation, in which half the jaw was removed, by sawing through the chin and across the ascending branch, was performed in March, 1822; his second, in which he exarticulated one-half, in May, 1822, died on the evening of the fourth day. Cusack removed the left half of the jaw in 1825, first sawing through the horizontal and afterwards the ascending branch, and then exarticulating the condyle. These several cases will be referred to presently.

I have thought it well to give this brief historical account of the amputations of the lower jaw, the authorities for which the reader can refer to; because the French claim excision of the jaw for Dupuytren, and the Americans, exarticulation of the jaw for Mott; but neither of these justly-celebrated Surgeons have title to the origination, or to the first performance of either operation, and their reputation will lose nothing by the just meed of merit being awarded to others, of whom, probably, their too ardent admirers had no cognizance.

(2) I regret I have no particulars, nor am able to obtain any particulars, but I have a perfect recollection of a case of my late colleague, Tyrrell's, about ten or fifteen years since, in which a man, who had been very severely salivated, had *necrosis* of the whole lower-jaw; the right branch and the chin had come away before his admission into our hospital, and the left came away whilst he remained in the house. The jaw separated on both sides from the joint. He was not much disfigured by the exfoliation, but had the appearance of a person the horizontal branches of whose jaw were very short and the chin very receding, his mouth was much pursed up, the skin of the chin puckered, and the upper lip much overhanging the lower. His speech was not very materially affected.—J. F. S.]

(*a*) Rust's Handbuch der Chirurgie, vol. vi. p. 503.

2843. *Excision of the middle of the lower-jaw* is performed in the following manner. The patient being seated in a chair and his head fixed by an assistant, a cut must be made in the healthy skin, beginning from the middle of the lower lip and carried over the chin down to the tongue-bone; or if the skin be diseased, two cuts must be made from the edge of the lip to the tongue-bone, where they meet at an angle enclosing the diseased skin. The soft parts are now to be separated on each side from the affected bone to the places where it is to be sawn through, at which the *periosteum* and one or more teeth must be removed to prevent any hindrance to the sawing. At this place a pointed bistoury must be thrust through the soft parts, forming the bottom of the mouth, on the inner side of the jaw, a narrow compress thrust through this opening, and the bone sawn through with a small bow-saw, or with Hey's or Heine's saw. The other side of the jaw is next treated in like manner, and then with a button-ended bistoury the soft parts attached to the inside of the sawn-off piece of bone, to wit, the insertions of the *m. mylo-* and *genio-hyoideus*, divided; in doing this, the bone must be held tightly with the fingers of the left hand, the knife kept close to the bone, and the tongue pressed aside by an assistant. The bleeding from the spouting vessels of the soft parts must be stopped by ligature, and that from the bone by pressure with wax or German tinder, or if need be, with the actual cautery; and the wound must be brought together at its upper part with the twisted, and at the lower part with the interrupted suture and supported with straps of plaster.

If the tumour be of large size, it may be convenient to make a second transverse cut through the former, on the middle of the chin, so as to be able to turn back four flaps.

The division of the soft parts from the insides of the jaw, *after* having sawn it through as above mentioned, is more convenient and easy than *first* separating the soft parts and then sawing. A narrow compress introduced and properly held by an assistant is a better guard than a spatula, strap of leather, horn, or leaden plate, and the like. Sawing the bone obliquely from before backwards as recommended by many, unless something more of the healthy bone can be thereby preserved, as also bringing the ends of the bone together, is objectionable. The same also applies to Delpech's advice, that the ends of the bone should correspond on both sides, even if for that purpose it be requisite to remove more healthy bone on the sound side. Delpech, in a case, where, by bringing the ends of the bone together, danger of suffocation was caused by the pressure of the tongue-bone, kept them together at proper distance with a piece of gold wire, and united the wound. The distance between the ends of the bone gradually diminished and they became firmly connected.

Only after removal of a small portion of the chin are the ends of the bone united by a *callus*-like tough tissue; generally and after the large loss of bone, a hard fibrous or cartilaginous intersubstance only is formed, which, however, has sufficient toughness for chewing.

At the moment when the soft parts on the inside of the bone are cut through, the tongue often retracts suddenly, and there is danger of choking. It is unnecessary to draw the tongue forward and fix it; its retraction depends on the contraction of the *m. sterno-hyoideus* after the separation of the *m. mylo-hyoideus* and *genio-hyoideus* if the head be drawn back; and, therefore, if the head be bowed towards the chest, the tongue resumes its proper place and the choking ceases, as I noticed in a case in which I removed the fore part of the jaw, in front of the *m. masseteres*, on both sides (*a*). Lallemand, in one case, opened the windpipe, and Delpech fixed the tongue with a hook.

If a large piece of the jaw-bone be removed, it may be convenient to introduce some lint between the ends of the bone, to prevent the soft parts dropping in.

[Dupuytren (*b*), according to his own statement, performed this operation, on 30th November, 1812, in a case of cancerous tumour, extending from the right cuspid tooth

(*a*) Chelius, Ueber Resection des Unterkiefers; in Heidelberg. Medic. Annalen, vol. i. part i.

(*b*) Clinical Lecture translated; in Lancet, 1833–34; vol. i. p. 56.

to the left branch of the jaw-bone; the part thus described was three times its natural size. The jaw was removed by sawing it through an inch in front of each of its angles. The patient suffered little after the operation; on the *twenty-seventh* day he was able to drive one of his cabriolets; on the *thirtieth* some small portions of bone came away; and *fifteen* days after, his cure was completed.

Graefe (*a*) removed, in the early part of 1821, from a woman aged forty, the front of the lower jaw, which had become involved in cancerous disease, sawing through it on each side; and the patient recovered completely in the course of five weeks.

The case in which Astley Cooper (*b*) operated, was a fungous medullary *exostosis* on the chin. He cut down through the skin on each side of the tumour, and then sawed through the healthy part of the jaw, cutting off the prominence of the chin, but without meddling with the alveolar processes, so that the arch of the jaw remained perfect. The operation was performed, I believe, in 1818, but certainly not later than in the beginning of the year following, and the woman did well. Although the operation was not of such importance as those just mentioned; yet as it was, so far as I am aware, the first upon the jaw performed in London, I have thought it right to notice it. The preparation is in St. Thomas's Museum.—J. F. S.]

2844. *In removing a portion of the side of the lower jaw without the condyle* the cut for laying bare the bone must be made in different ways, according to the size and seat of the bony tumour, sometimes from the corner of the mouth to below the edge of the jaw; still better is an oblique cut from the corner of the mouth to the place where the bone is to be cut through, or from the corner of the mouth in form of a ┘ cut; in very large swellings a ⊤ cut; when the skin is much diseased, two elliptical cuts from the corner of the mouth; or if the entire side with the angle or part of the ascending branch is to be removed, then a ⊔ cut or the like. The flaps are now to be separated close to the bone, held back by the assistants, and the soft parts on the inside of the bone carefully detached, the knife being carried close to the bone where it is to be sawn through. After the compress has been introduced, the bone is to be sawn through, first in front, and then the piece, grasped with the left hand, must be pressed downwards and outwards, and with the knife carried close to the bone all the remaining soft parts carefully separated to the extent of the tumour behind; the compress is then introduced, the bone held in this position by an assistant and cut off. The sawn-out bone is now drawn outwards and completely separated from the soft parts forming the bottom of the mouth, the bistoury being kept with the greatest care close to the bone. After stanching the bleeding, the wound must be brought together at the lip with the twisted, and on the cheek with the interrupted suture and supported with sticking plaster.

Sawing through the bone first in front is most convenient, because the operator can then draw it to him and turn it down. If the soft parts be divided from the whole inside of the bone before it is sawn through at the back part, the sawing is accompanied with greater difficulty than if the soft parts be divided afterwards, especially if the tumour be of large size.

Since Deadrick and Dupuytren first performed resection of the lower jaw, the operation has been very frequently performed and with much success.

[Deadrick (*c*) of Rogersville, Tennessee, is justly entitled to the merit of having first, in 1810, amputated a portion of the jaw of a child of fourteen, who had a tumour occupying the left side of the lower jaw. "An incision was commenced under the zygomatic process, and continued on the tumour, in the direction of the bone, to nearly an inch beyond the centre of the chin. A second incision was begun about midway, at right angles with the first, and extending a short distance down the neck. The integuments were now separated from their connexion with the tumour,

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(*a*) Jahresbericht des chirurgisch-augenärztlichen Instituts zu Berlin.—Graefe und von Walther's Journal, vol. iii. p. 256. 1822.

(*b*) Cooper and Travers's Surgical Essays, part i. p. 179. 1818.

(*c*) Amer. Med. Recorder, vol. vi. p. 516. 1826.

and the bone was sawed off immediately at the angle and centre of the chin. The wound was united in the usual manner, and the boy had a speedy and happy recovery."

MOTT's first operation was in 1821 (*a*), in which, after having sawn through the chin, and after the *maxilla inferior* had been laid bare, just below its division into two processes, and it appeared sound," he, "with a fine saw, made for the purpose, smaller and more convex than HEY's, began to saw through the bone obliquely downwards and backwards and finished with one less convex." This was for *osteosarcoma.*]

It is claimed for WARDROP (*b*), that he first, in England, in March, 1827, amputated the lower jaw, in a case of *exostosis*; the jaw was cut through first behind the last molar tooth, and then between the middle two incisive teeth.

The following are accounts of some of these operations:—

KLEIN; in Neue Chiron von TEXTOR, vol. i. part ii. p. 345.

CHELLAN; in Medical Review, and Anal. Journal. Philadelphia, 1824.

DELPECH; in Revue Médicale, vol. iv. p. 5. 1824.

LALLEMAND; in Journal Universel des Sciences Médicales, vol. xxviii. p. 340.

DYBECK; in FRORIEP's Notizen, vol. viii. p. 95.

SCHUSTER; in same, p. 304.

BEHRE, G., Bemerkungen über die theilweise Excision und Exarticulation des Unterkiefers, nebst den zur Geschichte dieser Operation gehörigen Fällen; in RUST's Magazin, vol. xxiii. part iii. p. 387.

MEYER, J. C., Dissert. de Exstirpatione partium degeneratarum Maxillæ Inferioris. Berol., 1824. 4to.

KOECKER, An Essay on the Diseases of the Jaws and their Treatment; with Observations on the Amputation of a part or the whole of the Inferior Maxilla. London, 1828.

DELPECH, Mémorial des Hôpitaux du Midi et de la Clinique de Montpellier. 1829; p. 123.

JAEGER; in RUST's Handbuch der Chirurgie, vol. vi. p. 496.

BOYER, Mémoire sur l'Amputation de l'Os Maxillaire Inférieur; in Journal Complément. du Dict. des Sciences Médicales, cah. 174.

DUPUYTREN, Leçons Orales de la Clinique chirurgicale, vol. iv. p. 625.

2845. *Excision of the lower jaw, together with the removal of its condyle* (*Exarticulatio Maxillæ Inferioris*) requires a different mode of making the cut, according to the different condition of the tumour and of the skin over it. The cut may be made from the corner of the mouth over the swelling, to the front of the ear, and the condyle of the jaw (MOTT, SCHINDLER); or to the hinder edge of the branch of the jaw, a second cut from the beginning to the end of the first cut, circumscribing the diseased skin, and thence in an oblique direction to the condyle (VON GRAEFE); or in very large swellings, and great disease of the skin, two elliptical cuts, of which the one passes in the direction of the base and branch of the jaw to the condyle, and the other upwards, by which the coronoid process is laid bare, the *m. temporalis* divided, and the joint opened at its fore part (SYME); or in shape of an oblong, four-cornered flap, from the corner of the mouth to the neighbourhood of the external maxillary artery, from thence at a distance of a quarter of an inch from the edge of the bone to the angle of the lower jaw, and then upwards to the front of the joint an inch distant from the ear (JAEGER). The flaps are now separated from the bone, and in doing this, injury of the Stenonian

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(*a*) New York Medical and Physical Journal, vol. i. p. 386.—American Medical Recorder, Jan., 1822. This case is given at length in GIBSON's Institutes and Practice of Surgery, vol. ii. p. 28. Philadelphia, 1827.

(*b*) Lancet, vol. xii. p. 27 1826-27.

duct and parotid gland, must be avoided. The *m. masseter* is cut through at the base of the lower jaw, the *m. buccinator* separated from the outer surface, and both together with the parotid gland raised up till the joint is laid bare. The soft parts are now separated from the inside of the bone, and the bone sawn through at its fore part, as already described, and the division of the soft parts from its inside completed. The bone is then depressed as much as possible, for the purpose of disengaging the coronoid process from the zygomatic arch, and rendering the *m. temporalis* tense. The condyle is thus thrown completely on the articular tubercle, so that there is perfect dislocation. The knife is now carried above the coronoid process and the tendon of the temporal muscle cut off, then over the semilunar notch between the two processes, and whilst the point of the knife is kept as close as possible to the condyle, the internal pterygoid muscle is divided. The jaw can now be further dislocated, which is so much the better, as thereby the condyle is still further separated from the vessels. Continuing close to the neck of the condyle, the stretched capsular ligament is cut into in front. The assistant pressing the jaw still more downwards, and moving it backwards, the condyle next becomes visible, and the knife being carried over it to the hinder ligament, cuts through it, whilst the edge of the knife is kept close to the bone, and the point not carried forward. After the bleeding vessels have been tied, the wound is brought together and managed as in resection of the jaw.

von Graefe (*a*), Mott (*b*), Langenbeck (*c*), and Jaeger (*d*) operate in this way, which is generally to be considered as the most safe and convenient. Cusack (*e*) considers it better, when in large tumours it is not thought right to lay hold of the bone sawn through in front, to grasp it between the angle and the condyle with strong forceps, and to press the condyle against the front of the capsular ligament, penetrate the joint, enlarge the opening with the button-ended bistoury, thrust the condyle out, and separate its other connexions with the capsule as well as with the external pterygoid muscle.

Jaeger speaks very decidedly against this sawing through the bone above its angle, and the after removal of the processes; in one case where the bone was completely separated from its branch, it was impossible to pull forward the remainder of the bone so as to separate the tendon of the temporal muscle from the coronoid process. The joint must be opened in front, and by pulling forwards the head of the bone with a strong hook, it must be gradually separated from its hinder connexions. Cutting through the tendon of the temporal muscle is then effected so easily that he advises the condyle should always be first set free. Holding the stump of the bone is especially difficult; and according to his experiments on the dead body, he considers sawing through the branch is difficult, and the exarticulation not rendered easier by doing so.

On the other hand, Schindler (*f*) justly observes that the exarticulation may be effected with complete certainty without sawing through the jaw at its hinder end, when the tumour of the bone is not of great size; but that every large tumour renders its removal indispensable, else the exarticulation may become unnecessarily difficult, and only be completed with some danger. In his case the swelling was so large, that even after removing its upper part, it was almost impossible to penetrate the joint, and effect the disarticulation with safety. He found no difficulty in the division of the *diseased* bone, and could grasp conveniently the remaining piece, although only an inch and a quarter long, with the fingers of his left hand, draw it well towards him, and easily dislocate the condyle. The patient recovered.

Mott, von Graefe, and Dzondi have held the previous tying the common carotid artery necessary, but experience has shown that this is superfluous, is dangerous, and no safeguard against bleeding (Jaeger, Schindler.)

If the removal of the entire jaw be necessary, the bone must be sawn through in the

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(*a*) Journal, vol. iii. part ii. p. 257.

(*b*) Above cited.

(*c*) Tiensch, Dissert. de Osteosarcomate partiali Maxillæ inferioris, deque hujus Resectione. Göttingæ, 1829.

(*d*) Above cited, p. 605.

(*e*) Dublin Hospital Reports, vol. iv. p. 37.

(*f*) von Graefe und von Walther's Journal vol. xvii. p. 568. 1831.

middle, and the extirpation performed on either side, as already directed (DUPUYTREN), (*a*).

[SAMUEL COOPER (*b*), after mentioning that WEPFER quotes a case of amputation of the lower jaw, which had occurred in his time, says, " Mr. ANTHONY WHITE, Surgeon to the Westminster Hospital, removed at Cambridge a considerable portion of the bone for an *osteosarcoma* many years ago. Unfortunately the case was not published, so that the revival and execution of the operation are generally referred to DUPUYTREN, who in 1812 performed his earliest excision of the lower jaw-bone." (p. 275.)

In consequence of SAMUEL COOPER'S statement, I was induced to inquire of my friend WHITE, for information in regard to his operation on the lower jaw, and I have much pleasure in communicating to the profession the following particulars, with which he has kindly furnished me, from which it appears, that he actually disarticulated the lower jaw-bone from its socket five years before GRAEFE, and six years previous to MOTT.

The following is WHITE'S

Case.—" In the summer of 1816 I was requested to see a man, named *Litchfield*, residing in the town of Cambridge, who for upwards of three years had been miserably affected with a disease of the lower jaw, occupying the entire left cheek, and wholly incapacitating him from opening his mouth. He states, that in attempting to bridle his master's horse, the animal, by an unexpected jerk of the head, struck him a violent blow on the under jaw; that the part for a few weeks remained painful and swollen, and although after a lapse of time, the enlargement occasioned by the injury had considerably diminished, yet a slight preternatural fulness and occasional pain remained. Some months after a rigidity in the motions of the jaw at its joints succeeded, accompanied with a slowly accumulating and hard enlargement extending from the ear nearly to the chin. By degrees, the jaw wholly lost its powers of motion, and finally the teeth became firmly fixed on those of the upper jaw, which was followed by the formation of small abscesses externally and internally. Thin fluids, as milk and broths, have been for the last two years his only nourishment; and during this time he has been compelled to sleep in an almost erect posture, on account of a perpetual internal discharge which, whilst he was in the horizontal posture, *poured* down his throat, producing, when he was about to sleep, a constant alarm of suffocation. The whole cheek, from the ear to the orbit, ranging down the side of the nose to the angle of the mouth, and thence to the under part of the chin, and again upwards to behind the lobe of the ear, presented one large irregular mass of *scirrhus*-feeling growth, studded with many sinuses, the windings of which were difficult to trace. The eye was so considerably projected from the socket, that the eyelids could cover but a very small portion of the globe, and such was the rigid thickening of the cheek, that much difficulty was experienced in introducing the finger within it for the purpose of examining the disease internally. I discovered, however, a point of the jaw-bone bare within the cheek, and by pressure, perceiving an obscure motion of its whole side, I was induced to believe that the bone was either carious or dead throughout its whole extent, although there had not been at any time the least exfoliation through either of the many sinuses. By repeated examinations, I was fully convinced of this impression being correct; and I afterwards by firmly grasping the chin and cheek, and then attempting to produce a lateral motion, distinctly perceived a grating sensation of the condyloid process on the skull. I now contemplated, if there was a possibility of removing the entire side of the bone, the cause and continuance of the extensive mischief, that the opposite joint when disentangled of its still adhering dead neighbour, might be restored to its important duties. I also considered that from the long-existing thickened and altered state of the left cheek and surrounding parts, little was to be feared from hæmorrhage, as the vessels were likely to have become obliterated, and if my conjecture was well founded, as to the death of the bone, the large artery which runs along the maxillary canal must also have perished.

" A few weeks elapsed before I was again able to visit Cambridge, and the patient being then in the same condition, and the operation having been proposed and explained to him being very desirous it should be done, I proceeded to its performance with the assistance of the present Professor of Comparative Anatomy in the University, Dr. CLARKE and Mr. HEADLEY, a practitioner in the town, to whose assistance I am much indebted.

Operation:—" The patient's head having been firmly fixed on the side upon a pillow, and my first object being to expose the bone, I began an incision, as near as I could guess, from the root of the zygomatic process of the temporal bone, and carried it obliquely

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(*a*) Above cited.

(*b*) Dictionary of Practical Surgery. Edition of 1838.

downwards and forwards considerably beyond the angle of the jaw towards the chin. In consequence of the thickened state of the integuments, the depth of the wound was very great before I could reach the bone; but having made sufficient room for the introduction of my finger, I was gratified in finding the bone without its *periosteum;* and with a curved bistoury, the incision was speedily finished upwards to the zygomatic arch, and downwards beyond the edge of the lower jaw opposite the third molar tooth. With the handle of a scalpel and the blade of a pair of forceps, sufficient separation was made to allow the point of the forefinger to range freely and to separate the surrounding diseased structure from the enclosed bone. By thus doing, I was enabled to slide the forefinger within the ascending branch of the jaw-bone into the mouth, and the thumb under its angle. On endeavouring to ascertain the degree of fixture which the bone might have, I discovered a complete fissure of separation in an oblique direction from where the finger entered the mouth towards the chin, through the entire jaw, but the bone was immovable at the temporo-maxillary articulation. After repeated unsuccessful attempts at dislodging the condyle, I determined to saw vertically through the ascending branch of the bone, between the condyloid and coronoid processes, calculating that the separation would be more easily effected by bringing it away in two or more pieces. I therefore applied a small straight and narrow saw upon this part with excellent effect, as its end passed with facility, in the required movements, under the zygomatic arch ; and Hey's saw was very useful in cutting through the thicker part towards the angle. I now with a pair of strong forceps, grasped the lower edge of the divided bone, and easily dislodged the coronoid process, and I removed it together with the lower part of this portion. Having thus gained considerable room, the separation of the condyle and remaining portion of the ascending branch became quite easy. The bone, although dead, retained its form unaltered. The glenoid cavity of the temporal bone was by the finger discovered to be denuded and rough. The carotid artery was now felt distinctly pulsating, the finger being enabled to rest upon it. One great object having been thus attained, we were anxious to ascertain the state of the other articulation, and were highly gratified in finding that a slight degree of motion existed which gradually became increased. Some few months after, I had the satisfaction of finding the wound and sinuses healed; the swelling and its warty character subsided ; the globe of the eye retired into its socket, and the motions of the jaw restored. The patient lived several years after."

Graefe (*a*), in 1821, exarticulated one side of the lower jaw of a young woman, having previously tied the carotid artery, for *hydrostosis carcinomatodes,* which had destroyed more than half the jaw, and on the left side reached up to the condyle. The swelling extended far back, and pressed on the important vessels and nerves of the neck. Internally it thrust the tongue against the right cheek, and so completely filled the mouth, that latterly the patient was able to swallow even fluids with the greatest effort, could only utter words indistinctly, and breath with extreme difficulty. As death by hunger or choking was all but certain, it was determined to run the risk of operating, in hope of saving her. The left common carotid artery, which was very large and pulsated strongly, was carefully tied, and immediately the pulsation in the temporal and facial arteries ceased. A cut was then made from the angle of the mouth to the hinder edge of the jaw; a second, which included the diseased mass, was carried from the front point of the first cut to its hind end; and a third, beginning at this latter point, was carried upwards in the direction of the condyloid process, above the joint and nearly to the ear. The outer surface first, and then the inner surface of the diseased half of the bone, were freed from the soft parts continuing the separation to the chin, and then, a piece of leather having been introduced, the jaw was cut through at the chin, and afterwards exarticulated. When the bleeding had been stanched, and the corner of the mouth carefully fixed, a simple dressing was applied. Up to the eighth day she was perfectly well, could speak loud and distinctly, ate, drank, and could press the remaining half of the lower firmly against the upper jaw; but on this day, after a violent thunder-storm in the previous night, she was suddenly and severely attacked with apoplexy, which gradually subsided into fatuity and speechlessness, accompanied with *hemiplegia.* By degrees the mental powers returned; the lameness of the right foot ceased entirely after some time; the wound healed completely under very simple treatment; the paralytic state of the right arm and tongue began to lessen more and more; she eats any food, is well nourished, is quite capable of walking to some distance, and is delighted with her condition, as she improves from month to month.

(*a*) Above cited, p. 257.

Mott (a) exarticulated, on 15*th May*, 1822, the right side of the jaw of a young man of eighteen, affected with *osteosarcoma*, which had existed eight years, had commenced at the molar teeth, filled the whole mouth and spread as far as the first bicuspid tooth on the opposite side. He first made a semilunar cut through the integuments from the lobe of the ear to the chin; sawed through the jaw at the second bicuspid tooth on the left side, and then exarticulated the jaw on the right side. The swelling weighed twenty-two ounces, and was as large as the head of a full-grown *fœtus*. The patient went on well, and on the morning of the fourth day two-thirds of the wound had healed; but on the evening of that day he died. On *examination*, the lungs were found violently inflamed; the anterior *mediastinum* contained a quantity of yellow lymph, nearly of the consistence of pus; the *pericardium* held a pint of yellow *serum*, and the *pleura* was enormously thickened. The inference drawn was—"Hence it appears clear, that the patient died of disease of the lungs which had no connexion with the operation." To which the editor in Graefe's journal appends ? with which most readers will probably agree.

Cusack (b), in his excellent *Report of the Amputation of portions of the Lower Jaw*, shows, that tying the carotid artery, as had been done by Graefe and Mott to guard against bleeding from wounding the external carotid or internal maxillary artery in exarticulation of the lower jaw, is unnecessary. "Neither of these arteries," he observes, "is in immediate contact with the jaw. The internal maxillary, which would appear more exposed to danger, inclines backwards in its passage behind the neck of the condyle, being distant about a quarter of an inch from the bone;—the natural structure of the joint allows this distance between the artery and articulation to be still further increased; so that by sawing the bone through at any point and separating the attachment of the temporal muscle, the capsular ligament may be opened anteriorly, the condyle dislocated, and the jaw disengaged, without endangering any vessel of consequence." (pp. 13, 14.) Cusack is the first Surgeon who, in this country, exarticulated the jaw, which operation he performed thrice in 1825 and once in 1826. After having separated the soft parts, and drawn as many teeth as were necessary, he cut through the jaw at the chin, and after having sawed across the ascending branch, "the cut extremity was seized in a strong pair of forceps, and the attachment of the temporal muscle having been divided, this fragment of bone was used as a lever to press the condyle against the anterior and external part of the capsular ligament, which was thus put on the stretch. An opening having been made into the capsule at this part, the disengagement of the condyle was effected by a blunt-pointed bistoury, carried cautiously round the joint, and dividing the attachment of the external pterygoid muscle. This second section of the bone may appear, at first view, unnecessary, when the jaw is to be removed from the articulation; but the body of the bone is, in general, so much disorganized, or so deeply involved in the tumour, that it could not be used as a lever to press the condyle against the capsule; a case might occur, however, in which the second division of the bone would be unnecessary." (p. 37.) As has been already noticed by Chelius, Jaeger objects to sawing through the ascending branch of the jaw, whilst, on the other hand, Schindler supports it. This operation has been repeatedly performed in England and Scotland without either previously tying the carotid artery or sawing across the ascending branch of the jaw.

Liston (c) recommends partially sawing through the bone at the chin and then by placing the cutting forceps in the notch to clip it through. He observes also, in regard to stanching the bleeding, that "much time and trouble will often be saved by at once looking for and securing the common trunk of the temporal and internal maxillary arteries as they emerge from under the border of the posterior belly of the digastric muscle." (p. 318.)]

Upon this subject the following writers may also be consulted :—

Gierl, Einige Bemerkungen über die Resection und Exarticulation des Unterkiefers; in Textor's Neuer Chiron, vol. ii. part ii. p. 345.

Lambert, Dissert. sistens casum Exsectionis dimidiæ Maxillæ Inferioris ex articulo, prævia subligatione carotidis. Aal., 1826.

Jaeger; in Rust's Handbuch der Chirurgie, vols. v. and vi.; and in Handwörterbuch der Chirurgie. Article *Resectio Ossium*, which treats very fully of the decapitation and resection of the several bones.

(a) New York Med. and Phys. Journal, vol. ii. p. 401.—American Medical Recorder, vol. v. 1822. —Graefe und von Walther's Journal, vol. iv. p. 547. I have been compelled to use Graefe's report, not having been able to see either of the American Journals quoted, nor to find it in any other Journal of the time, American or English. —J. F. S.

(b) Dublin Hospital Reports, vol. iv. 1827.

(c) Practical Surgery.

[PERRY (*a*) had a case of *necrosis* of the whole lower jaw, the front of which he removed by making an incision from the front of one masseter muscle to the other, dividing the bone on each side with the saw and nippers On the next day the right ascending branch which had dropped a little, was removed without difficulty; and three weeks after, the left, which adhered rather more firmly.]

SIXTH SECTION.—OF RESECTION OR EXCISION IN THE CONTINUITY OF BONES.

(*Resectio Ossium in continuitate*, Lat.; *Resection in der Continuität der Knochen*, Germ.; *Resection*, Fr.)

I.—OF RESECTION OF THE UPPER JAW.

2846. *Resection of the Upper Jaw*, performed at an early period for various diseases in the Highmorian cavity, with chisel and hammer, or with the sickle-shaped knife (DESAULT), has been in modern times specially brought into notice by DUPUYTREN in 1819, and since then performed by many Surgeons. It is indicated in *caries*, fungous degeneration of the alveolar process and of the upper jaw, in *osteosteatoma* and *osteosarcoma*, in medullary *fungus*, and polypous degeneration of the maxillary cavity. The performance of this operation is difficult, the shock very great; violent bleeding, and spreading of the inflammation to the brain may occur; and in malignant degeneration, the permanent benefit of the operation is very doubtful on account of the frequent recurrence of the disease.

[GENSOUL (*b*) shows that DUPUYTREN did *not* remove the whole jaw in 1819, but only followed JOURDAIN and DESAULT's method of scooping out the contents of the *antrum*; and in regard to SANSON and PINEL GRANDCHAMP, who were stated to have witnessed this operation, he says:—"I saw these two practitioners for the purpose of knowing what method had really been adopted. SANSON informed me that he had no knowledge of the fact of an entire removal of the superior maxillary bone; that he knew only of the operation performed in 1820, which was similar to DESAULT's, and of one other in the year 1824; and that in the latter case, a large piece of the edge of the alveolar process had been removed with a small saw. PINEL GRANDCHAMP said he had witnessed the two operations mentioned by SANSON, but he had never heard say that DUPUYTREN had even thought of removing the whole superior maxillary bone." (p. 10.)

But neither DUPUYTREN nor DESAULT, nor GARENGEOT, nor JOURDAIN, were the original performers even of this scooping operation, for AKOLUTHUS (*c*), a physician at Breslau, being consulted in 1693, by a woman who had a tumour on the jaw, which followed the extraction of a tooth, enlarged the mouth with a cut, removed part of the swelling, together with four teeth, but not being able at once to get completely round it, he attacked it several times, at intervals of a few days, sometimes with cutting instruments, and sometimes with the actual cautery, and at last succeeded in curing his patient.

The nearest approach to a total removal of the whole superior maxillary bone, if indeed the entire bone were not removed, is detailed in the following interesting and important case, which was operated on by Dr. THOMAS WHITE, the father of CHARLES WHITE, to whom reference has been recently made. He relates it among his own *Cases in Surgery*, and I am not aware of any other case in which such extensive mischief had been done by disease of the *antrum*, and yet the patient had recovered.

The patient was a woman "afflicted with a tumour betwixt the zygomatic process and the nose, arising from the lower part of the orbit of the left eye. It pressed the nostrils to one side, so as to stop the passage of the air through them, and thrust the eye out of

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(*a*) Med.-Chir. Trans., vol. xxi. p. 290. 1838.

(*b*) Lettre Chirurgicale sur quelques Maladies graves du Sinus Maxillaire et de l'Os Maxillaire Inférieure. Paris, 1833. 8vo.

(*c*) Ephemerid. Medico-physicarum, etc. Decad. iii. Ann. iv. Obs. 57. De horrendâ Epulide.

its orbit, so that it lay on the left temple, yet, though thus distorted, it still performed its office. The tumour occupied the greatest part of the left side of the face, extending from the lower part of the upper jaw, to the top of the forehead, and from the farthest part of the left temple to the external *canthus* of the eye. It had an unusual and unequal bony hardness. It was of a dusky livid colour, with varicose veins on the surface, and there was a soft tubercle projecting near the nose, where nature had endeavoured in vain to relieve herself." For the removal of this disease, he continues, "I began with a semicircular incision below the dislocated eye, in order to preserve that organ, and as much as possible of the orbicular muscle; then carrying the incision round the external part of the tumour, I brought it to the bottom of it, and then ascended to the place where I began, taking care not to injure the left wing of the nose. After taking away the external part of the tumour, which was separated in the middle by an imperfect suppuration, there appeared a large quantity of matter, like rotten cheese, in part covered by a bony substance, which, however, was so carious, as to be easily broken through. I scooped away abundance of this matter, with a great many fragments of rotten bones. Upon cleansing the wound from blood and filth, with a sponge, I found the left bone of the nose, and the zygomatic process carious, and easily removed them with an elevator. There were no remains of the bones composing the orbit of the eye, which were plainly destroyed by the same disease. The optic nerve was denuded as far as the *dura mater;* and the *dura mater* and pulsation of the vessels of the brain were apparent to the eye and touch. The left superior maxillary bone, in the *sinus* of which this disease had its origin, and remained a long time concealed, was surprisingly distended, and in some places became carious; it had exfoliated from the lower part to the sockets of the teeth, which part was in like manner removed. I applied the actual cautery to the rest of the bones and putrified parts, taking care not to injure the eye and neighbouring parts, which were sound. The patient drew her breath through the wound, and was so incommoded by the fœtid matter flowing into her throat, that she was obliged for several weeks to lie on her face to prevent suffocation. * * * The patient recovered. The eye returned to its place, and she enjoyed the perfect sight of it. The only inconvenience that remained was a constant discharge of *mucus* from the greater *canthus* of the eye, which I could never thoroughly cicatrize." (p. 135-38.)

As regards the actual proposer of the entire removal of the jaw, there can be no doubt, as will be presently shown, that in 1826 Lizars proposed it, recommending also that the carotid artery should be first tied. But Gensoul, seemingly without any knowledge of Lizars's proposition, performed the operation in the spring of 1827, and without previously tying the carotid or any other artery.—J. F. S.]

2847. The operation consists in the following acts:—*first*, cutting through the skin and muscles; *second*, cutting out the diseased part of the jaw, and, *third*, bringing the wound together. The different mode of conducting these acts depends especially upon the extent of disease in the bone.

2848. The patient is seated on a chair not very high, with his head resting on the breast of an assistant, who stands behind him. A cut is made from the corner of the mouth in a semicircular direction to the zygomatic arch; or a ⌋ or ⊤ shaped cut through the cheek; or a cut from the inner corner of the eye, through the upper lip, above the cuspid tooth, from the middle of which, or perhaps a little above the base of the nose, a second cut is made to within four lines of the lobe of the ear, and then a third, which, beginning five or six lines to the outer side of the outer angle of the orbit, ends at the extremity of the second cut. (Gensoul.) For the purpose of avoiding palsy of that half of the face, by cutting through the facial nerve, as well also as to prevent a salivary fistula, by wounding the Stenonian duct, the cut should be carried, according to Dieffenbach, in the middle line of the face, instead of through the cheek. The flaps, formed in one of these ways, are separated from the bone to sufficient extent, any spouting vessels, especially the transverse facial and the facial arteries tied, and the flaps held aside by an assistant, with his fingers, or with a blunt hook.

[There can be no doubt that Lizars is justly entitled to the credit of having, in 1826, proposed the *entire removal* of the superior maxillary. Speaking of "*polypi* or sarcomatous tumours which grow in the *antrum*," he says (*a*):—"All the cases that have come within my knowledge, (with the exception of one,) wherein these sarcomatous tumours have been removed by laying open the *antrum*, have either returned or terminated fatally. I am therefore decidedly of opinion, that unless we remove the whole diseased surface, which can only be done by taking away the entire superior maxillary bone, we merely tamper with the disease, put our patient to excruciating suffering, and ultimately to death. The inferior maxillary bone has now been nearly entirely removed for *osteosarcoma* with success, and I see no difficulty in accomplishing the same with one of the superior maxillary. We secure the common carotid artery for other tumours of the face, and for aneurism by anastomosis, and why not do it for so loathsome and fatal a disease as this? The steps or plan of the operation I would suggest for so fatal a disease, are, first, to secure the trunk of the common carotid artery of the affected side; next to make an incision through the cheek, from the angle of the mouth backwards or iniad to the *masseter* muscle, carefully avoiding the parotid duct, then to divide the lining membrane of the mouth, and to separate the soft parts from the bone upwards to the floor of the orbit; thirdly, to detach the half of the *velum palati* from the palate bone. Having thus divested the bone to be removed of its soft coverings, the mesial incisive tooth of the affected side is to be removed; then the one superior maxillary bone to be separated from the other, at the mystachial and longitudinal palatine sutures, and also the one palate bone from the other, at the same palatine suture, as the latter bone also will require to be removed either by the forceps of Mr. Liston, or a saw; thirdly, the nasal process of the superior maxillary bone should be cut across with the forceps; fourthly, its malar process, where it joins the cheek-bone; fifthly, the eye with its muscles and cellular cushion being carefully held up by a spatula, the floor of the orbit is to be cleared of its soft connexions, and the superior maxillary bone separated from the lacrymal and ethmoid bones, with a strong scalpel. The only objects now holding the diseased mass, are the pterygoid processes of the sphenoid bone with the pterygoid muscles. These bony processes will readily yield by depressing or shaking the anterior part of the bone, or they may be divided by the forceps, and the muscles cut with the knife. The bone or bones are frequently so soft in this disease, as to be easily cut with a knife or scissors. After the bone with its diseased tumour has been removed, the flap is to be carefully replaced, and the wound in the cheek held together by one or two stitches, adhesive plaster and bandage. In no other way do I see that this formidable disease can be eradicated." (p. 58.)

The operation which Lizars proposed, he endeavoured to perform in December, 1827, but without success, and he thus mentions it (*b*):—"I attempted to remove this bone for a medullary sarcomatous tumour of the *antrum*, from a miner or collier, after securing the common carotid artery of the affected side, but I was prevented by the hæmorrhagic disposition of the gum and palate, my patient having lost, in a few seconds, upwards of two pounds of blood, which welled out at every incision, as if there had been an aneurism by anastomosis. The man survived this attempt seventeen months." (p. 54.)

On *August* 1, 1829, Lizars performed his second operation (*c*); he first tied the trunk of the temporal and internal maxillary arteries, and also the external jugular vein which had been divided on the first incision. He cut through the alveolar process and bony palate on the left side of the palatine suture, and completely separated the upper jaw, with the saw, Liston's forceps and strong scissors; but the orbitar plate was separated from the eyeball by the handle of a knife. The tumour was medullary sarcomatous, and a portion of it, attached to the pterygoid process of the sphenoid bone, could not be detached; but part of the malar bone involved in the disease was removed. On the sixteenth day the wound had healed, and she left the house on that day. Three days after she expired suddenly, but no examination was permitted.

Lizars' third operation (*d*) was performed on 10*th January*, 1830, on a woman, after having first tied the external carotid artery. After slitting up the nostril, making a flap of the cheek, and divesting the bone of its coverings where it was to be sawn through, he applied the saw on "the front of the superior maxillary bone between the nostril and the mouth, or at the side of the mystachial suture; the palatine plate backwards from this, parallel with the longitudinal palatine suture, to near where the transverse palatine suture exists; across the same palatine plate towards the bulbous process;

(*a*) A System of Anatomical Plates, &c., part ix. The Organs of Sense, &c. Edinburgh, 1826. 8vo.

(*b*) Lancet. 1829-30; vol. ii.

(*c*) London Medical Gazette, vol. v. p. 92. 18 0.

(*d*) Lancet, above cited.

upwards between the bulbous process and the pterygoid processes of the sphenoid bone, across where it joins the cheek-bone; and, lastly, at its nasal process, parallel with the inferior margins of the lachrymal and nasal bones. I then with strong scissors cut the connexions of the orbitary plate with the *os planum* of the ethmoid bone, and orbitary process of the palate-bone, deep into the orbit, to the spheno-maxillary fissure, and was, lastly, able, by notching with the bone forceps at every point where the saw had been applied, to remove the entire bone which had its cavity filled with a firm sarcomatous tumour. The patient was able to walk about her room on the eighth day, and went out to take an airing on the thirtieth day; and she left the Hospital on 5th March following." (p. 55.)

I have, for the sake of convenience, put these three cases together; but although LIZARS first proposed the operation in this country, it was first performed by GENSOUL, of Lyons, on 26th May, 1827, who states that he was not aware what method LIZARS had employed (*a*), on a lad of seventeen, for a fibro-cartilaginous tumour of the upper jaw-bone, "occupying the whole left side of the face, and pushing to one side the orifice of the mouth; it extended from above downwards, from the floor of the orbit to two lines above the chin; from before backwards, from the nose, which was thrust to the right, to the top of the angle of the inferior maxillary bone." (p. 17.) He did not first tie the carotid artery, but "made a vertical cut from the inner corner of the eye vertically down through the upper lip, opposite the left cuspid tooth. From the middle of this cut, or rather nearly on a level with the floor of the nose, he made a second up to four lines from the front of the lobe of the ear, and a third cut beginning five or six lines to the outside of the orbit down to the end of the second, and then turned the flap up to the forehead. But for the purpose of completely exposing the tumour, he was obliged to continue, from the junction of the second and third cuts, another along the inner edge of the *m. masseter* to within an inch of the base of the lower jaw; and this lower flap he turned down. He then commenced with a chisel and mallet cutting through the outer margin of the orbit near the suture connecting the malar and frontal bones, into the spheno-maxillary fissure; and next cut through the zygomatic process of the malar bone. The maxillary bone being thus freed externally, he placed a very broad chisel below the inner angle of the eye, and carried it through the lachrymal bone and the orbitar plate of the ethmoid; and in the same way detached the corresponding part of the nasal bone. Cutting away with a bistoury all the soft parts connecting the wing of the nose to the upper jaw, he proceeded to separate the two superior maxillary bones, which he effected easily and quickly, having drawn the first left incisive tooth, by introducing a chisel not directly from before backwards, but by wriggling it through the mouth. Lastly, to detach the maxillary bone from the pterygoid processes of the sphenoid, and to destroy any connexions with the back of the ethmoid still remaining, he thrust the chisel into the tumour, passing it obliquely in the orbit, so as to cut through the superior maxillary nerve, which he was anxious not to drag, and to push it sufficiently deep to form a lever, so as that he could turn the tumour down into the mouth. This answered very well, and he had then only to divide with curved scissors and bistoury the attachments of the bone to the soft palate, so as to leave the latter unharmed. The operation was scarcely concluded, when the patient fainted, but revived on being laid upon his bed. The flaps of the wound yielded but a few drops of blood and the bottom oozed but slightly. About an hour after, no ligatures being needed, the edges were brought together with pins and twisted suture. On the eighth day the sutures were removed, and the wound was healed, except a very small portion of the middle cut." (p. 18-23.)]

2849. Cutting away the diseased jaw is now effected by means of HEY's saw, or the osteotome, in different ways, according to the extent of the disease. If only a portion of the upper jaw, with its broad base towards the alveolar process, have to be removed, two Λ shaped cuts united together, are to be made with the saw, including all the diseased part. If the swelling be broader above, a vertical cut must be made on each side, connected at the upper part with a transverse cut with the saw, or with the chisel and hammer. If the extent of the diseased bone be still greater, so that the whole jaw must be removed, the outer wall of the orbit must be divided with the chisel and hammer, near the suture connecting the cheek-bone with the outer orbitar process of the frontal bone, so that the chisel

(*a*) Above cited.

should penetrate into the spheno-maxillary fissure, and afterwards the zygomatic process of the cheek-bone is to be divided in like manner. The upper jaw-bone having been thus separated on the outside, a very broad chisel is placed below the inner corner of the eye, and held in such direction that when struck with the hammer, it passes through the lower part of the *os unguis* and the orbitar plate of the ethmoid bone. The ascending nasal process of the jaw-bone corresponding to the nose-bone, is to be separated in the same manner; and all the soft parts connecting the wing of the nose to the upper jaw are now to be cut through. The incisive teeth of the affected side are now to be inclined outwards, and whilst the chisel is entered between the two upper maxillary bones, not directly from before backwards, but obliquely from the mouth, their separation is very quickly and easily effected. Lastly, to separate the jaw-bone from the pterygoid process, and any still remaining connexions with the ethmoid bone behind, the chisel must be passed from the orbit obliquely downwards to loosen everything which has firm adhesion, and by leverlike movements, to push down the separated bone into the mouth. Nothing more remains but to cut through the attachment of the palate-bone to the soft palate, either with the curved scissors or with the bistoury, in such way that the latter may still remain connected with the pterygoid process, and with its other side. When the upper jaw-bone has been removed, there is a large cavity bounded on the inside by the mucous membrane of the *septum narium*, above and before by the lower straight muscle of the eye, by fat and cellular tissue, the outside by the cellular tissue beneath the *m. buccinator*, and behind by that part of the throat above the soft palate.

In five cases in which I have performed resection of the upper jaw with permanent success, I have operated in two cases according to the first; in one according to the second; and in two cases according to the third method; only that besides the chisel, I used HEY's saw for the division of the bones. In other two cases the disease returned.

HEYFELDER (*a*) performed resection of *both* jaws in the following way:—He made two cuts from the outer angles of the eyes into the corners of the mouth, then separated all the soft parts from the swelling to the inner corners of the eyes and to the nose-bones. He then raised this four-cornered flap upon the forehead, carried JEFFRAY's chain-saw through the upper fissure of the left orbit, and divided the connexion of the left upper jaw-bone and cheek-bone. In like manner he proceeded with the division of this bone from its connexion with the frontal, lachrymal, ethmoid, and nasal bones. In the same way, the right upper jaw-bone was separated from its connexions, and afterwards the *vomer* and the still remaining connexions were cut through with strong scissors. A leverlike pressure was made on the upper part of the tumour to complete the operation. Torsion and compression stanched the bleeding, and twenty-six sutures united the wound.

[SYME's (*b*) directions for performing excision of the upper jaw-bone are the most simple, and will not be found less convenient than any other. He says "two incisions should be made through the cheek, one extending from the inner angle of the eye directly downwards to the lip, the other beginning over the junction of the maxillary and malar bones and terminating at the angle of the mouth. The triangular flap thus formed is to be dissected from the tumour, and the margin of the orbit exposed." (p. 487.)

LISTON (*c*) performs this operation in the following manner:—"The extent of the disease is to be accurately ascertained, and the points at which the bones require to be separated decided upon. If the *os malæ* be involved, and it is necessary to remove it as well as the superior *maxilla*, a pair of straight tooth-forceps, a full-sized bistoury, copper spatulæ, powerful scissors, artery-forceps, and needles for interrupted and twisted suture will be sufficient. If the superior *maxilla* only, with, perhaps, some of the smaller bones, is to be removed, then the addition to the apparatus of a small saw will be necessary for the purpose of more readily effecting the separation of the *os malæ*

(*a*) Chirurgische und Augenkranken-Klinikum der Universität Erlangen, p. 81. 184[illegible].

(*b*) Principles of Surgery. Third Edition.

(*c*) Practical Surgery.

from its anterior attachment. The proceeding is not to be dreaded on account of its extent; indeed, removal of the superior *maxilla* alone is the more troublesome. Supposing that the more extensive extirpation is required, incisions must be made so as to expose freely the tumour and bones where it is proposed to cut them. First of all, one of the central incisors must be extracted, either the one on the affected side or the other, according to the extent of the tumour. I have been obliged to remove a considerable portion of the jaw opposite to that principally affected; and in that case one of the *molares* was removed, in order to admit of the division of the bones. The point of the bistoury is entered over the external angular process of the frontal bone, is carried down through the cheek to the corner of the mouth, and is guided by the fore and middle fingers of the one or other hand, as may be, placed in the cavity. A second incision made along and down to the *zygoma* falls into the other. Then the knife is pushed through the integument to the nasal process of the *maxilla*, the cartilage of the *alæ* is detached from the bone, and the lip is cut through in the mesial line. The flap thus formed is quickly dissected up and held by an assistant; the attachment of the soft parts to the floor of the orbit, the inferior oblique muscle, the infra-orbital nerve, &c., are cut, and the contents of the cavity supported and protected by a narrow bent copper spatula." (pp. 311, 12.) Or the flap may be formed in the following way with less extensive cuts. "The incisions were commenced at the inner *canthus* of the eye, carried by the side of and close to the *ala* of the nose, along the margin of the nostril, and then through the upper lip exactly in the middle line. Another incision was made from the commencement of the first, in a curved form, along the lower margin of the orbit, and, of course, in the direction of the fibres of the *orbicularis palpebrarum.* The flap thus formed was, by dissection, turned outwards and held by an assistant until the processes were cut." (p. 314.)

Fergusson's (*a*) directions for making the skin-flap are, "that an incision should be made from the margin of the upper lip towards the nostril, and then from the *ala*, as high as within half-an-inch of the inner *canthus* of the eyelids; next the cheek should be laid open from the angle of the mouth (or near it) as far as the zygomatic process of the malar bone, and, if necessary, an incision at right angles with this one should extend from the external angular process of the frontal bone, towards the neck of the lower jaw; now the flap between the nose and the wound in the cheek should be dissected from off the tumour, and turned upwards on the brow; then that portion of the cheek below and behind the wound should be turned downwards, and the mucous membrane divided, so as to expose freely the interior of the mouth." (p. 548.)

Cases may certainly occur in which the use of chisel and hammer may be necessary, but they cause great jarring and should not be used by choice, more especially as in general the detachment of the jaw can be most quickly and conveniently made, cutting pliers, or nippers, and strong scissors, as recommended by **Syme** and **Liston**. The former directs, that "one blade of a large pair of cutting pliers be introduced into the nose, and the other into the orbit, so as to divide the nasal process of the maxillary bone. The connexion with the malar bone is next separated in the same way, and then the palate, previous to which one of the incisor teeth must be extracted, if necessary. The Surgeon having now deprived the bone of all its principal attachments, wrenches it out either with his hands or strong forceps." (p. 487.) **Liston**'s proceeding is nearly the same. "With the cutting forceps the zygomatic arch, the junction of the *os malæ* and frontal bone by the transverse facial suture, and the nasal process of the superior *maxilla* are cut in succession; then, a notch having been cut out of the alveolar process, the palatine arch is clipped through by strong scissors placed along it, one blade in the nostril of the affected side, the other in the mouth. Then it is that an assistant will be prepared to place his fingers on the trunk of one or both carotids. The tumour is now shaken from its bed, and, as it is turned down, the remaining attachments are divided by the knife; the *velum palati* is carefully preserved, and also, if possible, the palatine plate of the palate bone." (p. 312.)

O'Shaugnessey (*b*) has given in his short but clever book, the following account of the removal of the upper jaw of a Hindu, of twenty-one years of age, which he performed in November, 1837. "An enormous growth completely occupied the left side of the face, rising to a level with the floor of the orbit, and extending a long way below the *inferior maxilla*, but unattached to it; occupying the whole of the anterior and left side of the mouth, and protruding between the lips, pressing down the lower jaw, so as almost to make the chin touch the throat, and flattening the nose, so as to leave but

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(*a*) Practical Surgery.

(*b*) On Diseases of the Jaws, with a brief Outline of their Surgical Anatomy, and a description of the Operations for their Extirpation and Amputation, &c. Calcutta, 1844. 8vo.

little trace of the prominence of that organ. Still there was no difficulty of swallowing, and the patient seemed to breathe without inconvenience, through the right *nares*. That portion of the tumour which protruded through the mouth was of a bright red colour, and covered with mucous membrane, having at its upper part the canine, and two incisors of its own side, with the central incisor of the opposite *maxilla* sticking out of it. The dimensions of this mass were as follows:—From the part near the ear to the most prominent part which protruded from the mouth, exactly twelve inches, and from that part which bulged below the *inferior maxilla* to the edge of the orbit, about ten inches. It looked, as near as may be, equal in size to the patient's head. * * * The principal source of pain to the patient seemed to be, from distension and pressure on the surrounding parts." (pp. 70, 71.) Notwithstanding its large size, the tumour seems to have been removed without much difficulty, the *zygoma* having been first cut through, and afterwards the malar bone into the spheno-maxillary fissure, with Liston's bone-nippers. The orbitar process of the superior maxillary bone and the nerve were next cut through with a strong knife, and afterwards the nasal process of the bone. The second incisive tooth on the opposite side having been drawn, the extent of the disease requiring it, the alveolar process and hard palate, as far back as the palatal process of the palate-bone, were then cut through with the bone-nippers," and now all the strong attachments of the tumour being completely severed, he had no difficulty in removing that mass, carefully separating with the knife the palatal process of the *superior maxilla* from the palatal process of the palate-bone, so as to preserve the soft palate from injury. The tumour weighed four pounds, it was nearly globular in form, having at its inferior surface a deep groove into which the lower jaw sunk, and the teeth before mentioned projecting from its anterior upper part." (pp. 73, 74.) The patient did not lose more than eight or nine ounces of blood, no ligatures were required, and a few minutes after the tumour was removed, all bleeding ceased. "The mouth remained as wide apart after the operation as before the tumour that distended it was removed; he appeared to have lost the power over the muscles that raise the lower jaw." (p. 78.) This, however, was gradually recovered, and on the eleventh day "the mouth was nearly as small as it ever could have been." (p. 79.) The patient completely recovered.

Hetling (*a*) of Bristol, relates a case of *Osteosarcoma*, or rather, as he says, it should be more properly called, from its true character, *medullary sarcoma* of both jaws, in a woman of twenty-three, upon whom he operated, removing part of the upper jaw, and part of the lower jaw, which latter he exarticulated. "The tumour extended from the upper to the lower jaw, to the latter of which it adhered so firmly, as to render it completely immovable, so that the patient could not masticate, and could scarcely articulate, being only enabled to answer questions put to her, by indistinctly mumbling 'yes,' or 'no.' In this state she was compelled to live upon fluids, and even these were with difficulty swallowed, deglutition being much impeded by the pressure of the tumour upon the internal part of the mouth." (p. 279.) The operation consisted in making a crucial cut through the cheek from the mouth to the lobe of the ear, and from the infraorbitar edge to the angle of the jaw, turning up the flaps and exposing the diseased mass, "the base of the tumour was found to occupy the palatine and maxillary portion of the upper jaw, and in its extensive growth, its head had been forced down and attached to the ridge of the lower jaw, nearly as far as the *symphysis*, extending along the whole of the alveolar border, nearly in a horizontal line from the mental *foramen* to the condyloid process, the whole of which portion was discovered to be either absorbed or in a state of *caries*, from the long-continued pressure of the tumour. In fact the tumour had so worked its way across the lower jaw, both inwards and outwards, that it was found buried in its substance, and, consequently, absorption of its body had been going on for some time on both sides of the bone. The substance of the tumour was next separated by the knife and fingers, from its base and adhesions. When this was effected, an extensive irregular surface of bone was found in a state of *caries*, extending in the upper jaw from the *pharynx* across the palate to the malar bone. Not the least vestige of the thin walls of the *antrum* remained. Fortunately, the floor of the orbit was left uninjured. With the assistance of Liston's bone-cutter, small saws, &c., every portion of diseased bone was taken away that could be safely removed, and the general surface scraped as carefully as possible with the knife, it being intended, finally, to apply the actual cautery over the whole plane of the diseased bone. Having accomplished this tedious and difficult part of the operation, ample room was found for amputating the lower jaw at the articulation; *caries* having extended as before stated, from near the *symphysis* along the whole of the upper margin to the joint. This extensive

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(*a*) Transactions of the Provincial Medical and Surgical Association, vol i. London, 1833. 8vo.

line of bone was then sawed off, except the condyloid process, which was afterwards easily disarticulated and removed with LISTON's bone-cutter, having first divided the fore part of its capsule, and also the temporal muscle from the coronoid process." (pp. 284, 85.) There was no bleeding of consequence, and the actual cautery was not applied. The flaps were brought together with sutures; on the fourth day the external wound had united, and in course of a fortnight, she walked about the ward. She left seven weeks after the operation, restored to a healthy appearance. This operation did not ultimately succeed, for HETLING states, "that the disease returned some time after the patient left the Infirmary, that she languished for about a twelvemonth, and died." (p. 336.)

This result is what usually happens in these cases of fungoid tumours of the jaw, if the whole of the bones affected, cannot be, or are not, removed by the operation. And LISTON has justly observed:—"If anything is to be done, it ought to be undertaken with a thorough determination to go *beyond the limits* of the morbid growth, to remove the cavity which holds it, and thus get quit, if possible, of all the tissues implicated, or which may have become disposed to assume a similar action. I know from experience, that this step, if adopted in time, may prove successful; and though at least a doubtful and very severe proceeding, not by any means unattended with danger, it is the only remedy. Let it be borne in mind, that it is only in the very earliest stage that any benefit can accrue even from the thorough extirpation; very generally the case is not presented until much too late, to one who understands the nature of the malady, who is capable of undertaking its treatment, and who has courage to propose and perform what is necessary. After the *parietes* have given way, and the growth has appeared in the nostril or cheek, the case is hopeless; and the patient, as, of old, were those who ventured on the ocean, may be numbered with the dead." (p. 307.)]

2850. After the wound has been properly cleansed, every spouting vessel must be tied or twisted, the parenchymatous bleeding stanched with cold water, or with the actual cautery, the application of which may be necessary to destroy any remaining diseased part, the edges of the wound brought together and closed with the interrupted or with the twisted suture, and the interspaces with strips of sticking plaster. Filling up the cavity with lint is injurious, but laying in some pieces of German tinder convenient, as when suppuration comes on, it easily and completely separates.

2851. The *after-treatment* must be conducted according to the general rule.

The dangers to be dreaded are violent inflammation, which may extend down the throat and to the brain; nervous symptoms; ill-conditioned copious suppuration, to contend with which frequent washing the mouth with warm water or any slightly aromatic infusion are most proper, at the same time supporting the strength; after-bleeding, for which compression with German tinder must be made, which I employed in two cases with success; *necrosis* of the cut surfaces, which require purifying washes for the mouth, and the ultimate removal of the separated pieces of bone; fungous granulations, which may be touched with caustic or with the actual cautery.

If the disease recur, it depends upon the previous extent of the resection and the other conditions of the patient whether any repetition of the operation should be undertaken. Palsy of the face diminishes and generally after a time ceases.

Upon this subject may be consulted also,

CHELIUS; in Heidelb. klinisch. Annalen.

GUTHRIE; in London Medical Gazette, vol. xvii. p. 315. 1835.

BLANDIN; in Gazette Médicale de Paris, vol. ii. p. 344. 1834.

ADELMANN, Untersuchungen über krankhafte Zustände der Oberkieferhöhle. Dorpat, 1844.

II.—Of Resection of the Blade-bone.

von Walther; in his Journal für Chirurgie und Augenheilkunde, vol. v. p. 271.

Haymann; in the same, p. 569.

2852. The practicability of this operation **von Walther** rested on his experiments upon the dead body. The blade-bone is laid bare by a crucial cut through the skin, forming flaps by turning it back, but leaving the muscles on the hinder surface of the bone; the insertions of the muscles are cut off close to the outer and inner edge of the bone, which is then sawn through transversely immediately below the spine, so that the upper angle and all the parts above the spine remain; lastly, the subscapular muscle is separated and the muscles generally on the front of the bone, which can be done with the handle of the knife. The trunk of the subscapular artery is not in this way injured.

2853. **Haymann** performed this operation successfully on account of a tumour attached to the blade-bone. He laid it bare with two large semilunar cuts through the skin and tendinous expansion, and cut it away with some quick strokes of the knife; the bone was then sawn obliquely through the spine, so that only the glenoid cavity and the parts above the spine remained. After the cure the upper arm could be moved in most directions, its elevation alone was interfered with.

Liston (1), **Janson** (2), **Luke** (3), **Syme** (4), **Wutzer**, and **Textor** have performed this operation (5).

[(1) **Liston** (*a*) removed in 1819 about three-fourths of the *scapula*, leaving only the glenoid cavity, processes, and half of its spine. It had been at first intended to remove "a very large, hard, inelastic tumour, firmly attached to the bone, and extending from its spine over all the lower surface of the bone;" but on attempting to detach it from the spine, "the knife and fingers suddenly slipped into its substance. This was attended with a profuse gush of florid blood, with coagula." **Liston** then considered it necessary to remove the portion of bone above mentioned. The disease seemed to have been medullary sarcoma. The disease, however, recurred, and the patient died.

(2) **Janson** (*b*) removed a large portion of the blade-bone which was involved in a tumour, but left the glenoid cavity.

(3) **Luke's** (*c*) operation in October, 1828, was for a medullary sarcomatous tumour, occupying the whole of the infraspinate pit of the blade-bone, and protruding from the subscapular-pit deeply into the arm-pit. The patient was a girl of fourteen, and had only noticed the swelling about six weeks. He "made an incision through the skin, beginning at the *axilla*, and extending it along the axillary margin of the tumour and anterior *costa*, and then with a sweep around the inferior angle to within a short distance of the spine of the *scapula*. He extended a second incision from the commencement to the termination of the first, along the lower margin of the spine; also through the skin, which being drawn upwards, exposed the spine and adjoining muscles. The muscles lying over the supra and infra spinal *fossæ* were next divided in the direction which he proposed to saw through the bone. * * * By grasping the tumour and inferior angle in his left hand, the *scapula* was steadied whilst he sawed it through in a direction from a little behind the glenoid cavity to a little above the superior angle, which latter was therefore removed, the spine being sawn through near to the root of the *acromion*." (p. 237.) The soft parts were then carefully separated from the tumour, which was detached with about three-fourths of the *scapula*. The bleeding was free, particularly in the neighbourhood of the armpit, where the axillary vessels and nerves were exposed. Twenty or thirty arteries were tied, and about a pint or a pint and a half of blood was lost; but the girl did not faint. The edges of the wound were brought together with straps of sticking plaster, the arm secured with a bandage to the side and the fore-arm put in a sling. In about two months the wound had healed completely. Eleven months after the operation, "the motions of the arm forward and backward were perfect, and in fact more than ordinary, the limb moving with

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(*a*) Edinburgh Medical and Surgical Journal, vol. xvi. p. 66 and p. 215.—Elements of Surgery, p. 190. Second Edition.

(*b*) Malgaigne, Médecine Opératoire, p. 236.

(*c*) London Medical Gazette, vol. v. 1830.

more than usual pliancy, but yet there was considerable power. She can also perform the actions of rotation outwards and inwards. The elevation of the arm from the side cannot be easily accomplished, and requires the aid of the opposite hand to raise it to a horizontal level. She possesses considerable power, and can lift with ease moderately heavy substances." (p. 239.)

(4) The operation of SYME'S (*a*) here alluded to, like LISTON'S, sprung out of another, which was amputation at the shoulder-joint for a fibro-cartilaginous tumour of the upper part of the *humerus*, having exposed which, he "easily cut through the *acromion* process and clavicle, and then depressing the arm, separated its remaining attachments. It now appeared that a fibrous *anchylosis* had existed between the glenoid cavity and the tumour, which had a cup-like form, and embraced it on all sides. He therefore sawed through the neck of the *scapula*, and removed a portion of the bone, including the coracoid process."

(5) TRAVERS in July, 1838, removed all the blade-bone immediately below its spine, for a large medullary sarcomatous tumour occupying the whole infraspinate pit. He first cut through the skin from the upper to the lower angle, and next from the root of the *acromion*, along the inferior *costa* to the beginning of the first cut. He then turned up the flap of skin to rather above the spine of the bone; detached the rhomboid muscles from its base and the *m. teretes* and *latissimus dorsi* from the inferior *costa* and angle, and next made a cut immediately beneath the whole length of the spine down to the bone, in doing which a large gush of bloody fluid, as in LISTON'S case, followed. The base of the bone first, and afterwards the inferior *costa*, were sawn through with a narrow saw; and it was then attempted to cut across the bone with cutting nippers, but this failing it was sawn through without difficulty, close to the spine. The bleeding was severe, and he was much exhausted, but only seven vessels were tied. The flap was laid down and fixed with two sutures and straps of sticking plaster. The wound healed kindly in about three weeks; but three months after the operation, a small tumour of the same kind appeared in the scar, and soon after another on the side of the chest. These gradually increased, burst, and threw out bleeding fungous growths; but he lingered a long while, and died just twelve months after the operation.

III.—OF RESECTION OF THE COLLAR-BONE.

2854. *Resection of the collar-bone*, which may be indicated in comminuted fracture, if the sharp ends of the fracture thrust outwards or injury to the vessels or nerves be feared, in *caries* and *necrosis*, and bony tumours, requires, according to the different states of the soft parts, a transverse cut along the bone, from the two ends of which a small vertical cut must be made, or two elliptical cuts, including the diseased part; or for a very large swelling a crucial cut. The bone is then carefully separated from the soft parts, the knife being always kept close to it; a spatula or a leather strap is thrust beneath the bone, which is then cut through with HEY'S saw or with the osteotome. The edges of the wound are brought together with sticking plaster, lint and compresses put over it, and the arm supported with DESAULT'S or BOYER'S fractured clavicle apparatus.

In the total removal of the collar-bone, which CUMING (*b*) performed after amputation at the shoulder-joint, and removal of the blade-bone in consequence of a crush by a gunshot-wound, MEYER (*c*) and ROUX (*d*), on account of *caries*, WARREN (*e*) and MOTT (*f*) for *osteosarcoma*, a cut was made along the collar-bone, and brought down a little below each end, at which a vertical cut about two inches long was made, the flaps turned back and the bone laid bare. The acromial end was then disjointed, the bone raised up and separated by disjointing its sternal end.

[TRAVERS (*g*) operated on a boy of ten years old, who, in consequence of a fall which probably broke the collar-bone without rupturing the *periosteum*, had large effusions of

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(*a*) Edinburgh Medical and Surgical Journal, vol. xlvi. p. 249. 1836.

(*b*) London Medical Gazette, vol. v. p. 273. 1830.

(*c*) VON GRAEFE und VON WALTHER'S Journal, vol. xix. p. 17.

(*d*) Bulletin général de Thérap., vol. vi. livr. 8.

(*e*) American Journal of Medical Science, vol. xiii. p. 17. 1833.

(*f*) American Journal of the Medical Sciences, vol. iii. p. 100. 1838.

(*g*) Med.-Chir. Trans., vol. xxi. 1838.

blood within it, which formed a tumour that by degrees involved and destroyed nearly the whole bone, except at its sternal end. He made "a crucial incision through the integument and *platysma myoides*, one limb of which was nearly in the line of the clavicle, and the other at right angles; and the flaps and fascial coverings successively dissected down to the external basis of the tumour. The *pectoralis* and deltoid muscles were then carefully detached from their clavicular origin, avoiding the cephalic vein, and the fibres of the *trapezius* and cleido-mastoid muscles divided on a director. One considerable vessel, in the situation of the *transversalis humeri*, required a prompt ligature. The circumference of the tumour was now well defined, though it was found to be firmly imbedded and adherent on its posterior aspect. Disarticulation of the scapular extremity of the bone was next effected without difficulty, and the mobility thus communicated to the mass facilitated the completion of the operation. A director was now worked beneath the bone, as near to the sternal articulation as was practicable, and with a pair of strong bone-nippers thus introduced, it was completely and clearly divided. The *subclavius* muscle and a part of the rhomboid ligament were now detached from the tumour, and the mass being well raised by an assistant, while the edges of the wound were kept wide apart by metallic retractors, the cervical prolongations of the tumour were separated from their remaining connections by a few touches of the scalpel, without injury to the subclavian vessels. (pp. 137, 38.) A twelvemonth after, the boy had the full and free use of the arm." (p. 147.)]

MOTT gives the following account of his removal of the collar-bone:—"The incision extended from the articulation at the *sternum* to the top of the shoulder, in a semicircular direction; below, the dissection, to get under the tumour, was on a line with the fourth rib; above, in a direction to the top of the shoulder, an inch below the thyroid cartilage and base of the jaw, and terminated at the same point with the first. The tumour of a bony character, was in contact with the coracoid process, insomuch that I was obliged to saw it through near the *acromion scapulæ*. Below, the vein was imbedded in the tumour, from the coracoid process to the *scalenus anticus*. Then my attention was directed to separating the tumour from the deep-seated *fascia* of the neck, to protect the deep-seated jugular and thoracic duct, the operation being on the left shoulder." "This operation far surpassed in tediousness, difficulty, and danger, anything which I have ever witnessed or performed. It is impossible for any description which we are capable of giving, to convey an accurate idea of its formidable nature. The attachment of the morbid mass to the important structures of the neck and shoulder of *the left side*, is sufficient to indicate its magnitude and difficulty." So arduous was the task of separating the diseased clavicle from the vessels and thoracic duct, that he was at one time, he said, almost inclined to doubt the possibility of accomplishing his purpose (*a*). The operation lasted four hours, and thirty vessels were tied. The tumour, when separated, was the size of two fists.

CHAUMET (*b*) of Bordeaux removed four-fifths of the clavicle, on account of a tumour originating from it.]

[IV.—RESECTION OF BLADE-BONE AND COLLAR-BONE TOGETHER.

This formidable operation was successfully undertaken by MUSSEY, of Cincinnati, who has published an interesting account of it (*c*). In 1818 a patient consulted him about a tumour connected with the thumb, for which the first metacarpal bone was removed. Several years later, pain attacked the humerus, which became greatly enlarged, and in 1831 the arm was amputated at the shoulder-joint. In 1836 the same disease appeared in the shoulder, and accordingly MUSSEY undertook the complete removal of the scapula and clavicle in September, 1837. "The tumour was round and prominent, measuring horizontally over the summit, from the anterior to the posterior margin of its base, 14 inches, and vertically, from the upper to the lower margin of its base, 10 inches." The integuments were dissected away from the clavicle, that bone disjointed from the sternum, its sternal extremity elevated and detached from the subclavius muscle, so as to admit of the finger of an assistant

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(*a*) American Journal of the Medical Sciences, vol. ii. p. 482. 1828.

(*b*) Gaz Med. de Paris, vol. i. p. 209. 1846.

(*c*) American Journal of the Medical Sciences, vol. xxi. p. 390. 1837.

being passed under it to secure the subclavian artery. The subsequent steps of the operation consisted in "plain, *coarse*, and sometimes rapid dissection." Having tied the subclavian artery, MUSSEY divided the accompanying vein, when a bubble of air passed into the latter, which caused the patient instantly to swoon, and he was roused with much difficulty from this state of collapse. "The immense wound, with flaps of seven or eight inches in extent, united by adhesion, and became consolidated and sound, *literally* without the formation of a *teaspoonful* of pus. In less than three weeks the patient was dismissed, and he rode home in a stage-coach between thirty and forty miles, and remained sound and well in November."

In 1841, RIGAUD (*a*) of Strasburg, amputated a man's arm at the shoulder-joint, for disease of the *humerus*. The man recovered, and remained well for eight months. A tumour was then found growing from the *scapula*, and RIGAUD removed the whole of this bone, together with the outer extremity of the clavicle, in 1842. In two months the parts were healed, and the man remained well in July, 1844.

M'CLELLAN, of Philadelphia, removed the *scapula* and clavicle from a boy. The patient recovered after the operation, but died from a return of the malignant disease in another part.

Dr. BLACKMAN, of New York, informs me, that GILBERT, of Philadelphia, has recently removed the *scapula* and clavicle, but I have not been able to ascertain the particulars of the operation.

I am specially obliged to my friend FERGUSSON for the following short account of the *removal of the whole scapula* and part of the clavicle, which he has this day (*February* 6, 1847) performed on a man aged thirty-three, who had his right arm amputated about three years ago for *caries* of the shoulder-joint. The *humerus* was extensively diseased, which is presumed to have been the reason for amputating; and the glenoid cavity being also affected, was removed at the same time, but either not sufficiently, or else there had been subsequent extension of the disease. Ten or twelve fistulous openings communicated from the surface with the carious bone, which seemed to be so extensively diseased that FERGUSSON considered it best to remove the whole bone. An incision was made, beginning an inch and a half from the sternal end of the clavicle, along that bone to the *acromion;* room was thus made to apply a saw to the middle of the bone. An incision was next made in the course of the spine of the *scapula*, nearly to the base. The first cut was then extended down into the *axilla*. The posterior flaps were now partially dissected off the thickened mass covering the *scapula;* the anterior next raised, then the *m. pectoralis minor*, next the *m. trapezius* were cut through, and the bone, being forcibly pulled outwards, was soon severed by the division of the other muscles and tissues. The anterior attachment of the *trapezius* had been in part divided when making way for the saw on the clavicle. The axillary vessel was not obliterated, but spirted freely when the finger was taken off the sub-clavian on the first rib, where it had been compressed; during the operation not more than four ounces of blood were lost. There was no shock and no pain, for the patient was under the influence of ether during the whole time. He was not aware that the operation was actually done, though he fancied it was going on.

GAETANI BEY (*b*), in the case of a boy fourteen years old, who had been severely wounded in the shoulder by the discharge of an old piece of artillery, which exploded whilst remelting, amputated at the shoulder joint, removed the whole blade-bone, which had been broken into several pieces, and cut off the acromial end of the collar-bone. In about two months the wounds were healed.

It may not be amiss to notice here five cases, in which the arm and the entire scapula were torn from the body by machinery. In the first case, related by BELCHIER (*c*), no arteries were tied, and the man was well in two months. JAMES (*d*) records a similar accident to a boy eleven years old, and here again no ligatures appear to have been required, and the cure was complete in nine weeks. SCARNELL (*e*) removed the outer third of the clavicle which projected from the wound, and tied the subclavian artery.

(*a*) American Journal of the Medical Sciences. 1844; p. 512. I have not been able to consult the original report.

(*b*) Annali Universali di Medicina, vol. xcviii. p. 5. 1841.—London Medical Gazette, vol. xxxi. p. 286. 1842.

(*c*) Philosophical Transactions, vol. xl. 1741.

(*d*) London Medical Gazette, vol. v. p. 497. 1830.

(*e*) Lancet. 1832; p. 114.

In a patient of Lizars's (*a*), the outer half of the clavicle was torn away, as well as the arm and scapula; a ligature was placed on the subclavian artery, which had bled but little, and the patient rapidly recovered. A similar case did equally well under the care of Cartwright (*b*).

V.—Of Resection of the Ribs.

2855. *Resection of the ribs*, which has often been performed for incurable disease restricted to the bone, as in *caries* and bony tumours, (Percy, Cittadini, Richerand, Milton, Antony, Mott, Clot-Bey, Jaeger, Textor,) requires the rib to be laid bare by a longitudinal or transverse cut; the intercostal muscles are then divided by a cut first at their upper and afterwards at their lower edge close to the bone, and the intercostal artery tied if it bleed. The *pleura* is then separated with a blunt needle and the rib cut off with an osteotome, which, in consequence of its sheath, best ensures the *pleura* from wound. The wound is to be lightly filled with lint or German tinder, and treated in the usual way.

In compound comminuted fractures of the ribs, the removal of the ends of the bone with the saw may be necessary; though here the greatest caution is always requisite to avoid injuring the *pleura*, which is closely connected with the rib, whilst in *caries* the *pleura* is generally thickened, and in part also separated from the rib.

In a case where about an inch-and-a-half of the ninth rib had been removed, Textor found a mass of new bone at the place where the removal had been made, although *caries* had extended backwards to a considerable extent, the whole of the diseased part not having been completely removed.

[Warren (*c*) removed, in January, 1836, a large, hard, immovable tumour, with a fistulous opening, and situated on the junction of the sixth and seventh ribs with their cartilages, which had existed about four years. He made an oblique cut over the swelling, and at each end of it another at right angles, so as to form two quadrilateral flaps, which being turned back, a firm cartilaginous substance was exposed, that had destroyed the natural appearance of the parts. This was removed, partly by shaving off with the scalpel, partly by bits with the cutting forceps, and both ribs were then found carious. These were carefully detached by a probe from the *pleura*, which was much thickened, and from the *diaphragm*, and three inches of the seventh rib with its cartilages, with two inches of the sixth, were removed by the chain saw and cutting forceps. There was little bleeding, the intercostal arteries having been obliterated in the course of the disease. He recovered. Warren also removed in March, 1837, an osteosarcomatous tumour, circular, above six inches in diameter,tand three in height, covering parts of the seventh, eighth, ninth, and tenth ribs, attached to all, but most firmly to the ninth. It had been growing six years. A ⊤ cut was made through the skin, and the flaps having been turned back, the insertions of the external oblique muscle were exposed and dissected off, as was also the *m. latissimus dorsi*, which latter was divided with some difficulty, and excessive pain. The tumour then found originating from the ninth, but firmly connected with the seventh, eighth, and tenth ribs, was then cut off from the former about an inch distant from its junction with its cartilage. The intercostals were then cut through, the diaphragm carefully separated from the rib and *pleura*, a director passed under the points where the rib was to be divided, and this done with cutting forceps, removing about two inches of the bone, and a part of its cartilage ; upon which the *diaphragm* immediately rose up like a *hernia*. There was little bleeding, and no vessel required tying. This case did well.

Dixon (*d*) removed the cartilage of the tenth rib of the left side, which had been broken off two years previously, and from a few weeks after had caused severe *neuralgia* at first in the part and then over the region of the stomach, and had become almost unbearable. A careful dissection exposed the cartilage unattached; it was easily removed; the pain immediately ceased, and the patient completely recovered in the course of a week.

(*a*) Fergusson's Practical Surgery, p. 235.

(*b*) Fergusson, p. 235.

(*c*) Boston Medical and Surgical Journal. 1837. —Lancet. 1837-38; vol. ii. p. 606.

(*d*) New York Quarterly Journal, No. I.—Lancet. 1839-40; p. 137.

In a case of *necrosis* of the fifth rib, of which Roux (*a*) removed with the chain saw, four inches, a collection of matter was found between it and the *pleura*, not, however, communicating with the cavity of the chest. Within a few days, respiration became oppressed. He was attacked with symptoms of *pleuritis* on the right side, and died. On *examination*, the right cavity of the chest was found to contain a considerable quantity of purulent *serum*, with albuminous flakes of recent formation. The lungs were filled with softened tubercles, as might be expected, the patient having been much emaciated, and coughed much, with copious expectoration, previous to the operation.]

V.—Resection of the Fibula.

[2855*. *Resection*, or *Extraction of the Fibula*, was proposed by Desault, but has been, however, only recently performed by Seutin (*b*). He detached the muscles from the bone, then applied the crown of a trephine below its head, slipped a narrow ribbon between the bone and the muscles on its inner side, down to the outer *malleolus*, and cut it off with a curved saw. Malgaigne removed the upper third of the *fibula*, and exarticulated it; but care was necessary to avoid injuring the anterior tibial nerve as it passed round the neck of the bone.]

2856. From this account of the several resections in the contiguity and continuity of the bones, it may be easily determined which mode of practice shall be pursued in the partial resection of some bones, to wit, the *radius*, *ulna*, *tibia*, *fibula*, *metacarpus* and *metatarsus*, and so on; as also in the entire extirpation of single bones.

For a careful collection of the cases hereto belonging, see

Jaeger, Handwörterbuch der Chirurgie, Article *Resectio ossium*, vol. v.

Kreitmair, Darstellung des Ergebnisses der im königl. Julius Spitale zu Würzburg seit 1821 angestellten Resectionen. Würzb., 1839.

Schirlinger, Beitrag zur Casuistik der Resectionen. Würzb., 1841.

Postscript.

[The year 1846 seems in a fair way to be known as the *Annus Mirabilis* of Surgery. The profession and the public in both hemispheres are in a complete ferment, consequent on the discovery by Morton, an American dentist, of a mode of producing insensibility, during which an *operation may be borne without pain*, nay, even rendered so agreeable as to induce a desire for its repetition. This safeguard against pain, consists in inhaling the vapour of ether, till the person is brought by it into the condition vulgarly known as " dead drunk," in which state the operation is to be performed.

From the account given by Bigelow (*c*), it appears that this proceeding was first largely employed to render tooth-drawing easy, and in consequence of the success which attended it, Warren of Boston, thought it might be useful in more serious Surgical operations. He, therefore, on 16*th October*, 1846, having put a patient under the ethereal influence, made " an incision near the lower jaw of some inches in extent. During the operation the patient muttered, as in a semi-conscious state, and afterwards stated that the pain was considerable, though mitigated; in his own words, as though the skin had been scratched with a hoe. There was, probably, in this instance, some defect in the process of inhalation, for on the following day the vapour was administered to another patient with complete success. A fatty tumour of considerable size, was removed by Dr. Hayward, from the arm of a woman, near the deltoid muscle. The

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(*a*) Journal Hebdomadaire, vol. vii. p. 299.—Lancet. 1829–30; vol. ii. p. 619.

(*b*) Malgaigne, Médecine Opératoire, p. 249. Fourth Edition. 1843.

(*c*) Insensibility during Surgical Operations produced by Inhalation; from Boston Medical and Surgical Journal; cited in Medical Times vol. xv. 1847.

operation lasted four or five minutes, during which time the patient betrayed *occasional marks of uneasiness*, but upon subsequently regaining her consciousness, professed not only to have felt no pain, but to have been insensible to surrounding objects, to have known nothing of the operation, being only uneasy about a child left at home." (p. 271.) Two other cases are also mentioned by BIGELOW, one of amputation above the knee, the other of removal of a portion of the lower jaw, during both which operations the patients were insensible to pain. An account of this wonderful discovery reached this country on 17*th December*, 1846, and on the 19*th*, a young female, having been intoxicated by inhaling ether for a minute and a half, had a molar tooth extracted from the lower jaw by ROBINSON (*a*). On the same day, LISTON (*b*) amputated the leg of one patient , and twisted off the great toe-nail of another, whilst they were under the influence of ethereal inhalation, and " neither of the patients knew, when they recovered from their stupor, that the operation had been performed." (p. 251.)

Since this time, the public and medical journals have been teeming with " painless operations" of all kinds, performed in all parts of the country.

That insensibility to pain, consequent on complete intoxication by breathing the fumes of ether, may be produced in many cases, is beyond all doubt; but that this condition will be induced in all instances is certainly untrue. Its failure does not depend, as is asserted, on the inhalation not being properly performed, for all persons are not alike affected by it, however carefully and perseveringly the ether may be administered. In proof of this, I may select, from among many instances, a case which occurred during the present month, (*February*, 1847,) at St. Thomas's Hospital. A man, whose toe-nail was to be twisted off, inhaled ether most assiduously for more than half an hour, without the slightest degree of insensibility being induced ; but it could not be objected that he was not fully subjected to the influence of the medicine, since after twenty hours his breath was still so impregnated with the ether, that it was strongly smelt by persons standing at the foot of his bed.

The avidity with which ethereal inhalation has been generally adopted, and apparently without consideration of the possibility of its indiscriminate employment being ever attended with danger, is one of the most remarkable circumstances connected with it. But, that it is not unfrequently accompanied with inconvenient and even dangerous results there can be no doubt. BIGELOW, in his paper before the Boston Society, mentions the more or less severe cough, which was immediately induced in several of the cases he relates. In another instance, I have known *hæmoptysis* and *bronchitis* induced, in a patient who had previously suffered from *hæmoptysis*. MORRIS (*c*) states of a woman, that " she did not appear at all timid, and began to inhale the vapour with the greatest confidence; after five or six inspirations she suddenly became deadly pale, and stated that she was suffocating, and refused to continue breathing the ether ; she had scarcely done speaking before she coughed violently three or four times, the flow of blood to the head was instantaneous ; she became quite purple in the face, the temporal veins were much distended, and the arteries throbbed violently ; she was perfectly sensible, and complained of a sense of suffocation, and that she should die. She remained in this state for five minutes at least, when the face began to assume its natural colour. She was a long time before she was able to leave the house ; and after she had been at home two hours had a fit, in which she was stiff and insensible for ten minutes. Although upwards of a fortnight has elapsed since she inhaled the vapour, she is far from recovered, complaining of a great deal of pain and confusion about the head, and oppression at the chest." He mentions also, of one boy, that " after having inhaled for a short time, instead of depressing him he became furious, called out loudly, and we had great difficulty in pacifying him ;" and of another, that the inhalation " brought on a most distressing cough, which continued so long as he breathed the vapour ; after a time it produced precisely the same effects as nitrous oxide ; he laughed most heartily, and looked quite idiotic. After waiting an hour he again tried the vapour, but with the same results." (p. 352.) COTTON also states, that in one of his cases " boisterous, hysterical-like spasms followed, as observed by Professor PARKER, requiring all the force of the bystanders to hold the patient. Further inhalation, however, served to effect the required degree of unconsciousness." (p. 353.)

It has also happened, that the patient has not recovered so speedily after the removal of the inhaler, as is commonly stated ; indeed, it was almost feared he was dead, and he only revived by pouring quantities of wine down his throat. In this case, the Surgeon who operated noticed, that all vital resistance of the tissues had ceased, and that the sensation given by his knife was as if he were cutting into a dead body.

(*a*) Medical Times, vol. xv. p. 273.
(*b*) Ibid.
(*c*) Ibid.

I have thought it right to mention these facts, to put practitioners on their guard in the employment of ethereal inhalation, for I feel assured, that unless more cautiously employed than hitherto, it will not be long before many disastrous consequences will result. A medical friend of high standing, with whom I had some conversation, insisted on the propriety of subjecting the patient to some preliminary trials of the effect of the inhalation before employing it at the time of operating. With this opinion I fully concur, and I should certainly adopt it, if I made up my mind to try inhalation at all; but upon that point I am not decided, for I have considerable doubt of the propriety of putting a patient into so unnatural a condition as results from inhaling ether, which seems scarcely different from severe intoxication, a state in which no Surgeon would be desirous of having a patient who was about to be submitted to a serious operation.

It was suggested, with much appearance of probability, that a far more important benefit than even the prevention of pain would arise from the use of ether; that it must lessen the shock to the nervous system generally, and that the after-treatment would be greatly facilitated by the absence of constitutional irritation. But experience has not confirmed these hopes. A patient who recently underwent an important operation, which was performed with rapidity and skill while he was quite unconscious, gradually sank, and died in three weeks, although little blood had been lost, and there was no organic disease found after death to account for the unfavourable termination of the case; there were two fresh effusions of blood beneath the arachnoid membrane. Another case, still more recent, terminated fatally within three days; the patient never rallied from the sedative effects of the ether, while, at the same time, the spasms in the stump of the amputated limb were unusually severe.

In conclusion I may observe, that there are no operations in which the use of ether seems to be so decidedly *contra-indicated*, as in those for the cure of Cataract; for, when skilfully performed, they cause hardly any pain, so that stupefying the patient is at least superfluous. But voluntarily to induce congestion in an organ, where inflammation, once set up, is so difficult to control, and where if unchecked, it produces such deplorable effects, appears to be the height of imprudence. Yet all this risk has been run, and the non-professional public have been astonished to hear how quickly a Cataract may be got out: the final results of the operations have not been so eagerly proclaimed.—J. F. S.]

END OF VOL. II.

ERRATA.

VOL. I.

Page	Line
176	12, *for* caoutchouc, *read* gelatine.
217	13, *dele* and Gonorrhœal ophthalmia
310	14, *for* feather, *read* spring
498	20, *for* except, *read* as
503	51, *for* fish-bone, *read* whale-bone
595	8, *for* Wolf's-jaw, *read* Wolf's-throat,
612	16, *read* habitual costiveness is not
612	31, *dele* , where
630	48, *for* graphit, *read* plumbago,
636	1, *for* scarabæi, *read* scabiei,
669	(*e*) *for* potass. Iod. gr. $\frac{1}{2}$, *read* potass. Iod. ʒss.
676	55, *point thus*, return more readily, make
725	17, *for* rosin, *read* gum,
781	26, *for* Upwards, *read* Downwards
775	46, *for* down-lying, *read* lying-in,

VOL. II.

1	8, *for* intestine, *read* viscus
20	18, *for* sore, *read* sac
79	42, *for* veins are, *read* vein is
704	11, *for* the naked eye, *read* a magnifying glass,
748	14, *after* with, *insert* that part,
751	11, *for* rose-crown, *read* rosary
773	42, *for* plaster, *read* layer
811	37, *for* with, *read* without
861	46, *for* hips, *read* lips,
911	9 & 10, *point thus*, larger quantity, than in the middle where it is

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Printed by William Clowes & Sons,
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